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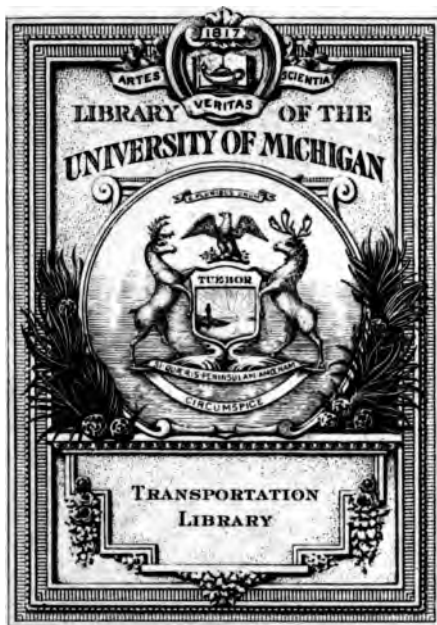
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DUPL

RAILROAD  
CURVE TABLES  

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## PREFACE.

This little volume is intended to supplement existing field books. Consequently the usual theoretical discussions have been omitted and the book reduced in size as much as possible. It is believed, however, that these tables will prove amply sufficient to meet the demands of the field engineer.

The correction quantities are original in that they are applicable to any function of a curve and are independent of the central angle. The rectangular co-ordinates, X and Y, are believed to be entirely new. The appendix, "Field Engineering Without a Field Book," is here presented for the first time.

The computations have been made with extreme care. The approximation of 5,730 feet for the radius of a one-degree curve, used in several previous books, has not been permitted in the preparation of the present volume.

While every effort has been made to secure absolute accuracy in the tables, the author makes no claim to infallibility. Should any errors be discovered, however slight, a favor will be conferred by reporting the same to the publishers.

Chicago, July, 1906.

R. S. HENDERSON.

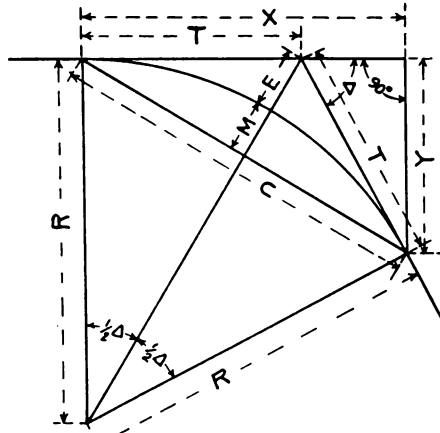
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## EXPLANATION OF TERMS.



## FORMULAS FOR A 1° CURVE.

$$\text{Radius} = R = \frac{50}{\sin 0.30'} = 5729.65$$

$$\text{Sub-tangent} = T = R \tan \frac{1}{2} \Delta$$

$$\text{External Secant} = E = R \operatorname{exsec} \frac{1}{2} \Delta$$

$$\text{Long Chord} = C = 2R \sin \frac{1}{2} \Delta$$

$$\text{Middle Ordinate} = M = R \operatorname{vers} \frac{1}{2} \Delta$$

$$\text{Rectangular Co-ordinate } X = R \sin \Delta$$

$$\text{Rectangular Co-ordinate } Y = R \operatorname{vers} \Delta$$

$$\text{Length of Curve} = L = 100 \Delta$$

## RAILROAD CURVE TABLES

## USE OF TABLES.

1. To find the functions of a 6° curve if
- $\Delta = 47^\circ 35'$
- .

(Tables I, II and III.)

For a 1° curve.

$T = 2526.1 \quad \text{Cor.} = 0.19$

$E = 532.14 \quad \text{Cor.} = 0.04$

$C = 4622.8 \quad \text{Cor.} = 0.34$

$M = 486.91 \quad \text{Cor.} = 0.04$

$X = 4230.0 \quad \text{Cor.} = 0.31$

$Y = 1864.9 \quad \text{Cor.} = 0.14$

$L = 47 \times 100 + 58.33 = 4758.33$

For a 6° curve.

$T = \frac{2526.1}{6} + 0.19 = 421.21$

$E = \frac{532.14}{6} + 0.04 = 88.73$

$C = \frac{4622.8}{6} + 0.34 = 770.81$

$M = \frac{486.91}{6} + 0.04 = 81.19$

$X = \frac{4230.0}{6} + 0.31 = 705.31$

$Y = \frac{1864.9}{6} + 0.14 = 310.96$

$L = \frac{4758.33}{6} = 793.06$

2. To find the functions of a curve of 220' radius if
- $\Delta = 92^\circ 23'$
- .

(Tables I, II and IV.)

For a 1° curve.

$T = 5973.1$

$E = 2547.2$

$C = 8269.7$

$M = 1763.3$

For a curve of 220' radius.

$T = 5973.1 \times .038397 = 229.35$

$E = 2547.2 \times .038397 = 97.80$

$C = 8269.7 \times .038397 = 317.53$

$M = 1763.3 \times .038397 = 67.71$

No correction required. Degree of curve =  $26^\circ 16.4'$ 

$$L = \frac{100 \left( 92 \frac{23}{60} \right)}{26 \frac{16.4}{60}} = 351.62$$

If chaining begins at one end of curve the sub-chord at the other end will be  $51.62 + \left( \frac{26.3}{10} \right)^2 \times 0.48 = 51.62 + 0.33 = 51.95$ , making  $L = 351.95$  instead of 351.62

3. Example showing application of the 1° curve functions in passing obstacles. (Tables I, II and III)

Given two tangents intersecting opposite to and 247' from a building.  $\Delta = 59^\circ 43'$ . Station of P.I. = 48+11.6

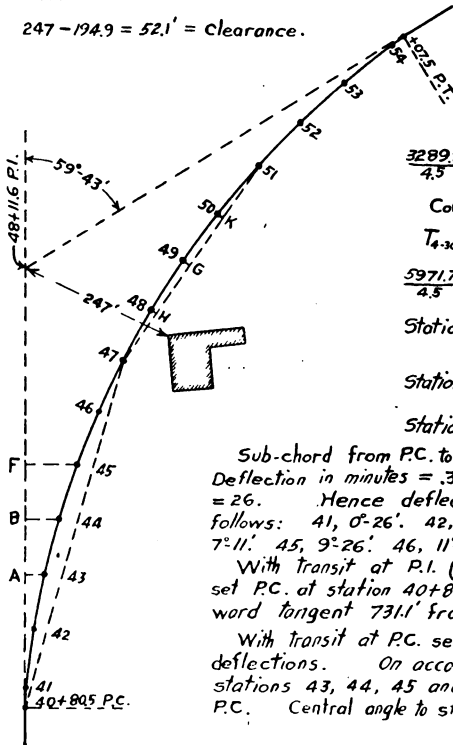
Required to run in the flattest curve of even degree or half degree that will clear the building by not less than 50'.

Maximum allowable value of  $E = 247 - 50 = 197'$ .

For  $\Delta = 59^\circ 43'$   $T_1 = 3289.2$ ,  $E_1 = 876.97$  and  $L_1 = 5971.7$

$$\frac{876.97}{197} = 4.45 \quad \text{Hence use } 4^\circ 30' \text{ curve.} \quad \frac{876.97}{4.5} = 194.9 = E_{4.30}$$

$$247 - 194.9 = 52.1' = \text{Clearance.}$$



$$\frac{3289.2}{4.5} = 730.93$$

$$\text{Cor.} = \frac{0.18}{4.5}$$

$$T_{4.30} = 731.11$$

$$\frac{5971.7}{4.5} = 1327.0 = L_{4.30}$$

$$\text{Station of P.I.} = 48+11.6$$

$$T = \frac{7+31.1}{4.5}$$

$$\text{Station of P.C.} = 40+80.5$$

$$L = \frac{13+27.0}{4.5}$$

$$\text{Station of P.T.} = 54+07.5$$

Sub-chord from P.C. to Station 41 = 19.5

Deflection in minutes =  $3 D \times \text{sub-chord} = 3 \times 45 \times 19.5 = 26$ . Hence deflections from P.C. are as follows: 41,  $0^\circ 26'$ ; 42,  $2^\circ 41'$ ; 43,  $4^\circ 56'$ ; 44,  $7^\circ 11'$ ; 45,  $9^\circ 26'$ ; 46,  $11^\circ 41'$ ; 47,  $13^\circ 56'$ .

With transit at P.I. (after  $\Delta$  has been measured) set P.C. at station 40+80.5 and set P.T. on forward tangent 731.1' from P.I.

With transit at P.C. set stations 41 and 42 by deflections. On account of obstacles, on line stations 43, 44, 45 and 46 are invisible from P.C. Central angle to station 43 =  $2 \times (4^\circ 56') = 9^\circ 52'$ .

## RAILROAD CURVE TABLES

For  $\Delta = 9^\circ 52'$   $X_1 = 981.81$   $\frac{981.81}{4.5} = 218.2 = X_{4.30}$

$Y_1 = 84.75$   $\frac{84.75}{4.5} = 18.83 = Y_{4.30}$

Calling P.C. station 0 set a point A at 2+18.2 on sub-tangent. Set station 43 by measuring 18.83' from A and 100' from station 42.

Central angle to station 44 =  $(9^\circ 52') + (4^\circ 30') = 14^\circ 22'$

For  $\Delta = 14^\circ 22'$   $X_1 = 1421.7$   $\frac{1421.7}{4.5} = 315.9 = X_{4.30}$

$Y_1 = 179.18$   $\frac{179.18}{4.5} = 39.82 = Y_{4.30}$

Set a point B at station 3+15.9 on sub-tangent. Set station 44 by measuring 39.82' from B and 100' from station 43.

Similarly for station 45,  $\Delta = 18^\circ 52'$ ,  $X_1 = 1852.8$ ,  $X_{4.30} = 411.7$ ,  $Y_1 = 307.83$ ,  $Y_{4.30} = 68.41$ . Set a point F at station 4+11.7 on sub-tangent.

For station 47,  $\Delta = 27^\circ 52'$   $C_1 = 2759.3$   $\frac{2759.3}{4.5} = 613.18$  Cor. = 0.15

$613.18 + 0.15 = 613.33 = C_{4.30}$ . Set station 47 by chord distance 613.33' from P.C. and deflection  $13^\circ 56'$ .

Obstacles on line prevent setting station 45 by measuring from station 44 or 46. With transit at F set station 45 by measuring 68.41' at right angles to sub-tangent.

With transit at station 47 set stations 46 and 48 by deflections. On account of obstacles on line stations 49 and 50 are invisible from station 47. Central angle station 47 to 51 =  $18^\circ 0'$ .

For  $\Delta = 18^\circ 0'$   $C_1 = 1792.6$   $\frac{1792.6}{4.5} = 398.36$  Cor. = 0.10  $398.36 + 0.10$

$= 398.46 = C_{4.30}$   $M_1 = 70.54$   $\frac{70.54}{4.5} = 15.68 = M_{4.30}$

Set station 51 by chord 398.46' from station 47 and deflection  $9^\circ 0'$  from tangent at station 47.

Set a point H on the chord 100' from station 47 and measure distance from H to station 48. Set a point K on the chord 100' from station 51. Set station 50 by measuring 100'

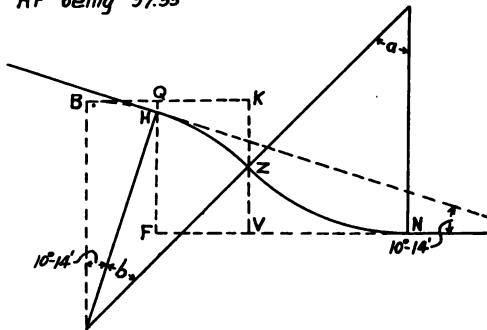
from station 51 and the same distance from K as H is from station 48. Set a point G at center of chord. Set station 49 by measuring 15.68' from G and 100' from station 50.

With transit at P.T. set stations 52, 53 and 54 by deflections and check on station 51.

In the foregoing example the corrections are used only where necessary. A little practice will indicate where they should be used and where they may be omitted.

#### 4. Use of co-ordinates X and Y as applied to reversed curves.

Given two tangents making an angle of  $10^{\circ}14'$  with each other. Required to connect them with an  $8^{\circ}$  reversed curve. The curve is to leave the first tangent at a point H, the perpendicular distance HF being 97.35'



If the curve HZ is produced beyond H to B increasing the central angle by  $10^{\circ}14'$  the tangent to the curve at B will be parallel to the second tangent FN.

$$\begin{aligned}
 \text{For } \Delta = 10^{\circ}14' \quad X_1 &= 1017.9 \quad \frac{1017.9}{8} = 127.24 \quad \text{Cor.} = 0.10 \quad 127.24 + 0.10 \\
 &= 127.34 = BQ. \quad Y_1 = 91.14 \quad \frac{91.14}{8} = 11.39 = QH \quad 97.35 + 11.39 = 108.74 = QF = KV. \\
 \frac{108.74}{2} &= 54.37 = KZ = ZV \quad 54.37 \times 8 = 434.96 \quad \text{Cor.} = .04 \times 8 = .32 \\
 434.96 - .32 &= 434.64 = Y_1 \text{ for central angle } \alpha. \quad \text{Hence } \alpha = 22^{\circ}28'. \\
 b &= (22^{\circ}28') - (10^{\circ}14') = 12^{\circ}14'
 \end{aligned}$$

## RAILROAD CURVE TABLES

For  $\Delta = 22^\circ 28'$   $X_1 = 2189.6$   $\frac{2189.6}{8} = 273.70$   $Cor = 0.22$   $273.70 +$   
 $0.22 = 273.92 = VN = BK$ .  $273.92 - 127.34 = 146.58 = QK = FK$ .

Length of curve  $HZ = \frac{1223.33}{8} = 152.9$

Length of curve  $ZN = \frac{2246.67}{8} = 280.8$

5. Use of middle ordinates in plotting a curve of large central angle.

Given a  $5^\circ$  curve.  $\Delta = 68^\circ 51'$ .

Bisect chord  $BG$  at  $H$

Connect  $H$  and  $F$ .

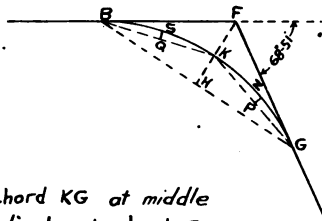
$$HK = \frac{1003.5}{5} = 200.7$$

$$KF = \frac{1216.5}{5} = 243.3$$

Draw  $PZ$  perpendicular to chord  $KG$  at middle point  $P$ . Draw  $QS$  perpendicular to chord  $BK$  at middle point  $Q$ .

$$QS = PZ = \frac{256.61}{5} = 51.3$$

Thus by successive bisection any number of points may be plotted on the curve.



6. Use of  $X$ ,  $Y$  and  $C$  in plotting a curve of small central angle.

Given a  $3^\circ$  curve.  $\Delta = 21^\circ 17'$ .

Required to plot points on the curve 50' apart.

Calling P.C. station 0 gives the following values of  $X$ ,  $Y$  and  $C$  for one half of the curve:

Station	$\Delta$	$X$	$Y$	$C$
0+50	$1^\circ 30'$	50.0	0.7	50.0
1	$3^\circ 0'$	100.0	2.6	100.0
+50	$4^\circ 30'$	149.8	5.9	150.0
2	$6^\circ 0'$	199.6	10.5	199.9
+50	$7^\circ 30'$	249.3	16.3	249.8
3	$9^\circ 0'$	298.8	23.5	299.7
+50	$10^\circ 30'$	348.0	32.0	349.5

Calling P.T. station 0 use the same values of  $X$ ,  $Y$  and  $C$  for the other half of the curve.

7. Use of long chords in plotting a transit line.  
Required to plot the following notes:

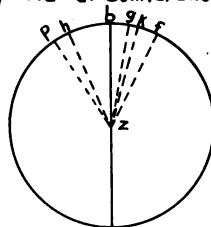
Tangent	Length	Angle	Total Angle	C, for Total Angle
b-	5500'			
x-	3973	28°-32' R.	28°-32' R.	2824.0'
g-	2800	16°-19' L.	12°-13' R.	1219.4
h-	5632	38°-44' L.	26°-31' L.	2628.1
k-	3826	40°-54' R.	14°-23' R.	1434.6
p.	3784	47°-16' L.	32°-53' L.	3243.4



The length and angle of the various tangents are measured, the total angles computed and C, taken from table II.

At a convenient point on the map and to a large scale draw a circle with radius of 5729.65'

Through the center z of the circle draw a line parallel to tangent b, intersecting the circumference at point b.



Using scale to which circle was drawn lay off chords as follows:

bf = 2824.0' to the right of b

bg = 1219.4 " " " "

bh = 2628.1 " " left " "

bK = 1434.6 " " right " "

bp = 3243.4 " " left " "

Draw tangent f parallel to zf, tangent g parallel to zg, tangent h parallel to zh etc.

Draw lengths of tangents to scale of map.

8. Use of tables VI and VII.

Table VI gives natural sines and cosines and table VII natural tangents and cotangents to seven decimals for angles varying by ten minutes.

The maximum error resulting from direct interpolation of intermediate angles is one unit in the sixth decimal place for table VI and four units for table VII. Hence these tables are more accurate than five-place tables varying by single minutes.

Tangents are given only for angles under  $45^\circ$  and cotangents for angles over  $45^\circ$  since direct interpolation is not permissible outside of these limits.

To find the tangent of an angle greater than  $45^\circ$  take the reciprocal of the cotangent of the angle.

To find the cotangent of an angle less than  $45^\circ$  take the reciprocal of the tangent of the angle.



## TABLES.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE, AND LENGTH OF A ONE-DEGREE CURVE.

Minutes	Decimals of a Degree	Length of a 1° Curve	Minutes	Decimals of a Degree	Length of a 1° Curve	Minutes	Decimals of a 1° Curve	Length of a 1° Curve
0	.0000	0.00	20	.3333	33.33	40	.6667	66.67
1	.0167	1.67	21	.3500	35.00	41	.6833	68.33
2	.0333	3.33	22	.3667	36.67	42	.7000	70.00
3	.0500	5.00	23	.3833	38.33	43	.7167	71.67
4	.0667	6.67	24	.4000	40.00	44	.7333	73.33
5	.0833	8.33	25	.4167	41.67	45	.7500	75.00
6	.1000	10.00	26	.4333	43.33	46	.7667	76.67
7	.1167	11.67	27	.4500	45.00	47	.7833	78.33
8	.1333	13.33	28	.4667	46.67	48	.8000	80.00
9	.1500	15.00	29	.4833	48.33	49	.8167	81.67
10	.1667	16.67	30	.5000	50.00	50	.8333	83.33
11	.1833	18.33	31	.5167	51.67	51	.8500	85.00
12	.2000	20.00	32	.5333	53.33	52	.8667	86.67
13	.2167	21.67	33	.5500	55.00	53	.8833	88.33
14	.2333	23.33	34	.5667	56.67	54	.9000	90.00
15	.2500	25.00	35	.5833	58.33	55	.9167	91.67
16	.2667	26.67	36	.6000	60.00	56	.9333	93.33
17	.2833	28.33	37	.6167	61.67	57	.9500	95.00
18	.3000	30.00	38	.6333	63.33	58	.9667	96.67
19	.3167	31.67	39	.6500	65.00	59	.9833	98.33

POSITIVE CORRECTION FOR LENGTH OF SUB-CHORD FOR A 10° CURVE.

Sub-chord	Correction
10'	.013
20	.024
30	.035
40	.043
50	.048
60	.049
70	.045
80	.037
90	.022

*The correction varies as the square of the degree of curve.*

*Thus for a 15° curve and sub-chord of 70' the correction*

$$= \left(\frac{15}{10}\right)^2 \times .045 = .101'$$

I	O°						I°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	0.00	0.000	0.00	0.000	0.00	0.000	50.00	0.218	100.00	0.218	100.00	0.873
1	0.83	0.000	1.67	0.000	1.67	0.000	50.84	0.226	01.67	0.226	01.66	0.902
2	1.67	0.000	3.33	0.000	3.33	0.001	51.67	0.233	03.33	0.233	03.33	0.932
3	2.50	0.001	5.00	0.001	5.00	0.002	52.50	0.241	05.00	0.241	05.00	0.962
4	3.33	0.001	6.67	0.001	6.67	0.004	53.34	0.248	06.67	0.248	06.66	0.993
5	4.17	0.002	8.33	0.002	8.33	0.006	54.17	0.256	08.33	0.256	08.33	1.024
6	5.00	0.002	10.00	0.002	10.00	0.009	55.00	0.264	10.00	0.264	09.99	1.056
7	5.83	0.003	11.67	0.003	11.67	0.012	55.84	0.272	11.67	0.272	11.66	1.088
8	6.67	0.004	13.33	0.004	13.33	0.016	56.67	0.280	13.33	0.280	13.33	1.121
9	7.50	0.005	15.00	0.005	15.00	0.020	57.50	0.289	15.00	0.289	14.99	1.154
10	8.33	0.006	16.67	0.006	16.67	0.024	58.34	0.297	16.67	0.297	16.66	1.188
11	9.17	0.007	18.33	0.007	18.33	0.029	59.17	0.306	18.33	0.306	18.33	1.222
12	10.00	0.009	20.00	0.009	20.00	0.035	60.00	0.314	20.00	0.314	19.99	1.257
13	10.83	0.010	21.67	0.010	21.67	0.041	60.84	0.323	21.67	0.323	21.66	1.292
14	11.67	0.012	23.33	0.012	23.33	0.048	61.67	0.332	23.33	0.332	23.33	1.327
15	12.50	0.014	25.00	0.014	25.00	0.055	62.50	0.341	25.00	0.341	24.99	1.364
16	13.33	0.016	26.67	0.016	26.67	0.062	63.34	0.350	26.67	0.350	26.66	1.400
17	14.17	0.018	28.33	0.018	28.33	0.070	64.17	0.359	28.33	0.359	28.32	1.437
18	15.00	0.020	30.00	0.020	30.00	0.079	65.00	0.369	30.00	0.369	29.99	1.475
19	15.83	0.022	31.67	0.022	31.67	0.088	65.84	0.378	31.67	0.378	31.66	1.513
20	16.67	0.024	33.33	0.024	33.33	0.097	66.67	0.388	33.33	0.388	33.32	1.551
21	17.50	0.027	35.00	0.027	35.00	0.107	67.50	0.398	35.00	0.398	34.99	1.590
22	18.33	0.029	36.67	0.029	36.67	0.117	68.34	0.408	36.67	0.408	36.66	1.630
23	19.17	0.032	38.33	0.032	38.33	0.128	69.17	0.418	38.33	0.418	38.32	1.670
24	20.00	0.035	40.00	0.035	40.00	0.140	70.00	0.428	40.00	0.428	39.99	1.710
25	20.83	0.038	41.67	0.038	41.67	0.152	70.84	0.438	41.66	0.438	41.65	1.751
26	21.67	0.041	43.33	0.041	43.33	0.164	71.67	0.448	43.33	0.448	43.32	1.793
27	22.50	0.044	45.00	0.044	45.00	0.177	72.50	0.459	45.00	0.459	44.99	1.835
28	23.33	0.048	46.67	0.048	46.67	0.190	73.34	0.469	46.66	0.469	46.65	1.877
29	24.17	0.051	48.33	0.051	48.33	0.204	74.17	0.480	48.33	0.480	48.32	1.920
30	25.00	0.055	50.00	0.055	50.00	0.218	75.01	0.491	50.00	0.491	49.98	1.963
31	25.83	0.058	51.67	0.058	51.67	0.233	75.84	0.502	51.66	0.502	51.65	2.007
32	26.67	0.062	53.33	0.062	53.33	0.248	76.67	0.513	53.33	0.513	53.32	2.052
33	27.50	0.066	55.00	0.066	55.00	0.264	77.50	0.524	55.00	0.524	54.99	2.096
34	28.33	0.070	56.67	0.070	56.67	0.280	78.34	0.536	56.66	0.535	56.65	2.142
35	29.17	0.074	58.33	0.074	58.33	0.297	79.17	0.547	58.33	0.547	58.32	2.188
36	30.00	0.079	60.00	0.079	60.00	0.314	80.01	0.559	60.00	0.559	59.98	2.234
37	30.83	0.083	61.67	0.083	61.67	0.332	80.84	0.570	61.66	0.570	61.65	2.281
38	31.67	0.088	63.33	0.088	63.33	0.350	81.67	0.582	63.33	0.582	63.31	2.328
39	32.50	0.092	65.00	0.092	65.00	0.369	82.51	0.594	65.00	0.594	64.98	2.376
40	33.33	0.097	66.67	0.097	66.67	0.388	83.34	0.606	66.66	0.606	66.65	2.424
41	34.17	0.102	68.33	0.102	68.33	0.408	84.17	0.618	68.33	0.618	68.31	2.473
42	35.00	0.107	70.00	0.107	70.00	0.428	85.01	0.631	70.00	0.630	69.98	2.522
43	35.83	0.112	71.67	0.112	71.67	0.448	85.84	0.643	71.66	0.643	71.64	2.572
44	36.67	0.117	73.33	0.117	73.33	0.469	86.67	0.656	73.33	0.655	73.31	2.622
45	37.50	0.123	75.00	0.123	75.00	0.491	87.50	0.668	75.00	0.668	74.98	2.672
46	38.33	0.128	76.67	0.128	76.67	0.513	88.34	0.681	76.66	0.681	76.64	2.725
47	39.17	0.134	78.33	0.134	78.33	0.535	89.17	0.694	78.33	0.694	78.31	2.775
48	40.00	0.140	80.00	0.140	80.00	0.559	90.01	0.707	79.99	0.707	79.97	2.827
49	40.83	0.146	81.67	0.146	81.66	0.582	90.84	0.720	81.66	0.720	81.64	2.880
50	41.67	0.152	83.33	0.152	83.33	0.606	91.68	0.733	83.33	0.733	83.30	2.933
51	42.50	0.158	85.00	0.158	85.00	0.630	92.51	0.747	84.99	0.747	84.97	2.987
52	43.33	0.164	86.67	0.164	86.66	0.655	93.34	0.760	86.66	0.760	86.64	3.041
53	44.17	0.170	88.33	0.170	88.33	0.681	94.18	0.774	88.33	0.774	88.30	3.095
54	45.00	0.177	90.00	0.177	90.00	0.707	95.01	0.788	89.99	0.788	89.97	3.150
55	45.83	0.183	91.67	0.183	91.66	0.733	95.84	0.802	91.66	0.802	91.63	3.206
56	46.67	0.190	93.33	0.190	93.33	0.760	96.67	0.816	93.33	0.816	93.30	3.262
57	47.50	0.197	95.00	0.197	95.00	0.788	97.50	0.830	94.99	0.830	94.96	3.318
58	48.33	0.204	96.67	0.204	96.66	0.816	98.34	0.844	96.66	0.844	96.63	3.375
59	49.17	0.211	98.33	0.211	98.32	0.844	99.18	0.858	98.33	0.858	98.30	3.432

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

11

2°							3°							
T	E	C	M	X	Y		T	E	C	M	X	Y		
100.01	0.873	199.99	0.873	199.96	3.490	150.04	1.964	299.97	1.963	299.97	7.882	0		
100.85	0.887	201.66	0.887	201.63	3.549	150.87	1.986	301.64	1.985	301.53	7.940	1		
101.68	0.902	03.33	0.902	03.29	3.608	151.70	2.008	03.30	2.007	03.20	8.028	2		
102.51	0.917	04.99	0.917	04.96	3.667	152.54	2.030	04.97	2.029	04.86	8.116	3		
103.35	0.932	06.66	0.932	06.62	3.727	153.37	2.052	06.63	2.052	06.52	8.205	4		
104.18	0.947	08.32	0.947	08.29	3.787	154.21	2.075	08.30	2.074	08.19	8.294	5		
105.01	0.962	09.99	0.962	09.96	3.848	155.04	2.097	09.97	2.096	09.85	8.384	6		
105.85	0.978	11.66	0.977	11.62	3.909	155.87	2.120	11.63	2.119	11.52	8.475	7		
106.68	0.993	13.32	0.993	13.29	3.971	156.71	2.143	13.30	2.142	13.18	8.566	8		
107.51	1.009	14.99	1.009	14.95	4.033	157.54	2.166	14.96	2.165	14.85	8.657	9		
108.35	1.024	216.66	1.024	216.62	4.096	158.38	2.188	316.63	2.188	316.51	8.749	10		
109.18	1.040	18.32	1.040	18.28	4.159	159.21	2.212	18.30	2.211	18.17	8.841	11		
110.01	1.056	19.99	1.056	19.95	4.223	160.04	2.236	19.97	2.235	19.84	8.934	12		
110.85	1.072	21.66	1.072	21.61	4.287	160.88	2.259	21.63	2.257	21.50	9.027	13		
111.68	1.088	23.32	1.088	23.28	4.352	161.71	2.282	23.29	2.281	23.17	9.121	14		
112.51	1.105	24.99	1.104	24.95	4.417	162.54	2.305	24.96	2.304	24.83	9.215	15		
113.35	1.121	26.65	1.121	26.61	4.483	163.38	2.329	26.63	2.328	26.49	9.310	16		
114.18	1.138	28.32	1.137	28.28	4.549	164.21	2.353	28.29	2.352	28.16	9.405	17		
115.02	1.154	29.99	1.154	29.94	4.616	165.05	2.377	29.96	2.376	29.82	9.501	18		
115.85	1.171	31.65	1.171	31.61	4.683	165.88	2.401	31.62	2.400	31.49	9.597	19		
116.68	1.188	232.32	1.188	232.27	4.751	166.72	2.425	332.29	2.424	332.15	9.694	20		
117.52	1.205	34.99	1.205	34.94	4.819	167.55	2.449	34.96	2.448	34.81	9.791	21		
118.35	1.222	36.65	1.222	36.60	4.887	168.38	2.474	36.62	2.473	36.48	9.888	22		
119.18	1.240	38.32	1.239	38.27	4.956	169.22	2.498	38.29	2.497	38.14	9.987	23		
120.01	1.257	39.99	1.257	39.93	5.026	170.05	2.523	39.95	2.522	39.80	10.085	24		
120.85	1.274	41.65	1.274	41.60	5.096	170.88	2.548	41.63	2.547	41.47	10.18	25		
121.68	1.292	43.32	1.292	43.26	5.166	171.72	2.573	43.29	2.572	43.13	10.28	26		
122.51	1.310	44.98	1.310	44.93	5.237	172.55	2.598	44.95	2.597	44.80	10.38	27		
123.35	1.328	46.65	1.327	46.59	5.309	173.39	2.623	46.62	2.622	46.46	10.48	28		
124.18	1.346	48.32	1.345	48.26	5.381	174.22	2.648	48.28	2.647	48.12	10.59	29		
125.02	1.364	249.98	1.364	249.92	5.453	175.06	2.674	349.95	2.672	349.79	10.69	30		
125.85	1.382	51.65	1.382	51.59	5.526	175.89	2.699	51.62	2.698	51.45	10.79	31		
126.68	1.400	53.32	1.400	53.25	5.600	176.72	2.725	53.28	2.724	53.11	10.89	32		
127.52	1.419	54.98	1.419	54.92	5.674	177.56	2.751	54.95	2.749	54.78	10.99	33		
128.35	1.438	56.65	1.437	56.58	5.748	178.39	2.776	56.61	2.775	56.44	11.10	34		
129.18	1.456	58.31	1.456	58.25	5.823	179.23	2.803	58.28	2.801	58.10	11.20	35		
130.01	1.475	59.98	1.475	59.91	5.898	180.06	2.829	59.95	2.827	59.77	11.31	36		
130.85	1.494	61.65	1.494	61.58	5.974	180.90	2.855	61.61	2.854	61.43	11.41	37		
131.68	1.513	63.31	1.513	63.24	6.050	181.73	2.881	63.28	2.880	63.09	11.52	38		
132.51	1.532	64.98	1.532	64.91	6.127	182.56	2.908	64.94	2.906	64.76	11.62	39		
133.36	1.552	266.65	1.551	266.57	6.205	183.40	2.934	366.61	2.933	366.42	11.73	40		
134.19	1.571	68.31	1.571	68.24	6.282	184.23	2.961	68.27	2.960	68.08	11.84	41		
135.03	1.591	69.98	1.590	69.90	6.361	185.07	2.988	69.94	2.987	69.75	11.94	42		
135.86	1.611	71.64	1.610	71.57	6.439	185.90	3.015	71.61	3.014	71.41	12.05	43		
136.69	1.630	73.31	1.630	73.23	6.519	186.74	3.042	73.27	3.041	73.07	12.16	44		
137.53	1.650	74.98	1.650	74.90	6.598	187.57	3.069	74.94	3.068	74.74	12.27	45		
138.36	1.670	76.64	1.670	76.56	6.679	188.40	3.097	76.60	3.095	76.40	12.38	46		
139.19	1.691	78.31	1.690	78.23	6.759	189.24	3.124	78.27	3.123	78.06	12.49	47		
140.03	1.711	79.98	1.710	79.89	6.840	190.07	3.152	79.94	3.150	79.73	12.60	48		
140.86	1.731	81.64	1.731	81.56	6.922	190.91	3.180	81.60	3.178	81.39	12.71	49		
141.70	1.752	283.31	1.751	283.22	7.004	191.74	3.207	383.27	3.206	383.05	12.82	50		
142.53	1.773	84.97	1.772	84.89	7.087	192.58	3.235	84.93	3.234	84.72	12.93	51		
143.37	1.793	86.64	1.793	86.55	7.170	193.41	3.263	86.60	3.262	86.38	13.04	52		
144.20	1.814	88.31	1.814	88.22	7.254	194.24	3.292	88.26	3.290	88.04	13.16	53		
145.03	1.835	89.97	1.835	89.88	7.338	195.08	3.320	89.93	3.318	89.70	13.27	54		
145.87	1.857	91.64	1.856	91.54	7.422	195.91	3.348	91.60	3.347	91.37	13.38	55		
146.70	1.878	93.31	1.877	93.21	7.507	196.75	3.377	93.26	3.375	93.03	13.50	56		
147.53	1.899	94.97	1.899	94.87	7.593	197.58	3.406	94.93	3.404	94.69	13.61	57		
148.37	1.921	96.64	1.920	96.54	7.679	198.42	3.434	96.59	3.432	96.35	13.73	58		
149.20	1.942	98.30	1.942	98.20	7.765	199.25	3.463	98.26	3.461	98.02	13.84	59		

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	4°						5°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	200.08	3.492	399.92	3.490	399.68	13.96	250.16	5.459	499.85	5.453	499.37	21.80
1	00.92	3.522	401.59	3.520	401.34	14.07	51.00	5.495	501.51	5.490	501.03	21.95
2	01.75	3.551	03.26	3.549	03.01	14.19	51.83	5.532	03.18	5.526	02.69	22.09
3	02.59	3.580	04.92	3.578	04.67	14.31	52.67	5.568	04.84	5.563	04.35	22.24
4	03.42	3.610	06.59	3.608	06.33	14.43	53.50	5.605	06.51	5.600	06.01	22.39
5	04.26	3.640	08.25	3.637	07.99	14.54	54.34	5.642	08.17	5.637	07.67	22.54
6	05.09	3.669	09.92	3.667	09.66	14.66	55.17	5.679	09.84	5.674	09.33	22.68
7	05.92	3.699	11.58	3.697	11.32	14.78	56.01	5.717	11.50	5.711	10.99	22.83
8	06.76	3.729	13.25	3.727	12.98	14.90	56.84	5.754	13.17	5.748	12.65	22.98
9	07.59	3.760	14.91	3.757	14.64	15.02	57.68	5.791	14.83	5.785	14.31	23.13
10	208.43	3.790	416.58	3.787	416.30	15.14	258.51	5.829	516.50	5.823	515.97	23.28
11	09.26	3.820	18.25	3.818	17.97	15.27	58.35	5.867	18.16	5.861	17.63	23.43
12	10.10	3.851	19.91	3.848	19.63	15.39	60.18	5.904	19.83	5.898	19.29	23.57
13	10.93	3.881	21.58	3.879	21.29	15.51	61.02	5.942	21.49	5.936	20.95	23.73
14	11.77	3.912	23.24	3.909	22.95	15.63	61.85	5.980	23.16	5.974	22.61	23.88
15	12.60	3.943	24.91	3.940	24.62	15.76	62.69	6.019	24.83	6.012	24.27	24.04
16	13.43	3.974	26.57	3.971	26.28	15.88	63.52	6.057	26.49	6.050	25.93	24.19
17	14.27	4.005	28.24	4.002	27.94	16.00	64.36	6.095	28.15	6.089	27.59	24.34
18	15.10	4.036	29.90	4.033	29.60	16.13	65.19	6.134	29.82	6.127	29.25	24.50
19	15.94	4.068	31.57	4.065	31.26	16.25	66.03	6.173	31.48	6.166	30.91	24.65
20	216.77	4.099	433.24	4.096	432.93	16.38	266.86	6.211	533.15	6.205	532.57	24.80
21	17.61	4.131	34.90	4.128	34.59	16.51	67.70	6.250	34.81	6.243	34.23	24.96
22	18.44	4.163	36.57	4.159	36.25	16.63	68.53	6.289	36.48	6.282	35.89	25.12
23	19.28	4.194	38.23	4.191	37.91	16.76	69.37	6.328	38.14	6.321	37.55	25.27
24	20.11	4.226	39.90	4.223	39.57	16.89	70.20	6.368	39.81	6.361	39.21	25.43
25	20.95	4.259	41.56	4.255	41.23	17.01	71.04	6.407	41.47	6.400	40.87	25.59
26	21.78	4.291	43.23	4.287	42.90	17.14	71.87	6.447	43.14	6.439	42.53	25.74
27	22.61	4.323	44.89	4.320	44.56	17.27	72.71	6.486	44.80	6.479	44.19	25.90
28	23.45	4.355	46.56	4.352	46.22	17.40	73.54	6.526	46.47	6.519	45.84	26.06
29	24.28	4.388	48.22	4.385	47.88	17.53	74.38	6.566	48.13	6.558	47.50	26.22
30	225.12	4.421	449.89	4.417	449.54	17.66	275.21	6.606	599.80	6.598	599.16	26.38
31	25.95	4.454	51.56	4.450	51.20	17.79	76.05	6.646	51.46	6.638	50.82	26.54
32	26.79	4.487	53.22	4.483	52.87	17.93	76.89	6.686	53.13	6.679	52.48	26.70
33	27.62	4.520	54.89	4.516	54.53	18.06	77.72	6.727	54.79	6.719	54.14	26.86
34	28.46	4.553	56.55	4.549	56.19	18.19	78.56	6.767	56.45	6.759	55.80	27.02
35	29.29	4.586	58.22	4.583	57.85	18.32	79.39	6.808	58.12	6.800	57.46	27.18
36	30.13	4.620	59.88	4.616	59.51	18.46	80.23	6.849	59.78	6.840	59.12	27.35
37	30.96	4.653	61.55	4.649	61.17	18.59	81.06	6.890	61.45	6.881	60.77	27.51
38	31.80	4.687	63.21	4.683	62.83	18.72	81.90	6.930	63.11	6.922	62.43	27.67
39	32.63	4.721	64.88	4.717	64.50	18.86	82.73	6.972	64.78	6.963	64.09	27.84
40	233.47	4.755	466.54	4.751	466.16	18.99	283.57	7.013	566.44	7.004	565.75	28.00
41	34.30	4.789	68.21	4.785	67.82	19.13	84.40	7.054	68.11	7.046	67.41	28.16
42	35.13	4.823	69.87	4.819	69.48	19.27	85.24	7.096	69.77	7.087	69.07	28.33
43	35.97	4.857	71.54	4.853	71.14	19.40	86.07	7.137	71.44	7.128	70.73	28.50
44	36.80	4.891	73.20	4.887	72.80	19.54	86.91	7.179	73.10	7.170	72.38	28.66
45	37.64	4.926	74.87	4.922	74.46	19.68	87.74	7.221	74.77	7.212	74.04	28.83
46	38.47	4.961	76.54	4.956	76.12	19.82	88.58	7.263	76.43	7.254	75.70	29.00
47	39.31	4.995	78.20	4.991	77.78	19.96	89.42	7.305	78.10	7.296	77.36	29.16
48	40.14	5.030	79.86	5.026	79.44	20.09	90.25	7.347	79.76	7.338	79.02	29.33
49	40.98	5.065	81.53	5.061	81.11	20.23	91.09	7.389	81.42	7.380	80.68	29.50
50	241.81	5.100	483.20	5.096	482.77	20.37	291.92	7.432	583.09	7.422	582.33	29.67
51	42.65	5.136	84.84	5.131	84.43	20.52	92.76	7.474	84.75	7.465	83.99	29.84
52	43.48	5.171	86.53	5.166	86.09	20.66	93.59	7.517	86.42	7.507	85.65	30.01
53	44.32	5.207	88.19	5.202	87.75	20.80	94.43	7.560	88.08	7.550	87.31	30.18
54	45.15	5.242	89.86	5.237	89.41	20.94	95.26	7.603	89.75	7.593	88.97	30.35
55	45.99	5.278	91.52	5.273	91.07	21.08	96.10	7.646	91.41	7.636	90.62	30.52
56	46.82	5.314	93.19	5.309	92.73	21.23	96.94	7.689	93.08	7.679	92.28	30.69
57	47.66	5.350	94.85	5.345	94.39	21.37	97.77	7.732	94.74	7.722	93.94	30.87
58	48.49	5.386	96.52	5.381	96.05	21.51	98.61	7.776	96.40	7.765	95.60	31.04
59	49.33	5.422	98.18	5.417	97.71	21.66	99.44	7.819	98.07	7.809	97.25	31.21

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

13

6°							7°							I
T	E	C	M	X	Y		T	E	C	M	X	Y		
300.28	7.863	599.73	7.852	598.91	31.39	350.44	10.71	699.57	10.69	698.27	42.71	0		
01.11	7.907	601.40	7.896	600.57	31.56	51.28	10.76	701.24	10.74	700.32	42.91	1		
01.95	7.957	03.06	7.940	02.23	31.74	52.11	10.81	02.90	10.79	701.58	43.12	2		
02.79	7.995	04.73	7.984	03.88	31.91	52.95	10.86	04.56	10.84	03.23	43.32	3		
03.62	8.039	06.39	8.028	05.54	32.09	53.79	10.91	06.23	10.89	04.89	43.52	4		
04.46	8.081	08.06	8.072	07.20	32.26	54.62	10.96	07.89	10.94	06.54	43.73	5		
05.29	8.129	09.72	8.116	08.86	32.44	55.46	11.02	09.55	10.99	08.19	43.94	6		
06.13	8.172	11.38	8.161	10.51	32.62	56.30	11.07	11.22	11.05	09.85	44.14	7		
06.96	8.217	13.05	8.205	12.17	32.80	57.13	11.12	12.88	11.10	11.50	44.35	8		
07.80	8.262	14.71	8.250	13.83	32.98	57.97	11.17	14.55	11.15	13.15	44.56	9		
308.64	8.307	616.38	8.294	615.48	33.15	358.81	11.22	716.21	11.20	714.81	44.76	10		
09.47	8.352	18.04	8.339	17.14	33.33	59.64	11.28	17.87	11.25	16.46	44.97	11		
10.31	8.397	19.71	8.384	18.80	33.51	60.48	11.33	19.54	11.31	18.12	45.18	12		
11.14	8.442	21.37	8.430	20.46	33.69	61.32	11.38	21.20	11.36	19.77	45.39	13		
11.98	8.487	23.03	8.475	22.11	33.87	62.15	11.43	22.86	11.41	21.42	45.60	14		
12.81	8.533	24.70	8.520	23.77	34.06	62.99	11.49	24.53	11.46	23.08	45.81	15		
13.65	8.578	26.36	8.566	25.43	34.24	63.83	11.54	26.19	11.52	24.73	46.02	16		
14.49	8.624	28.03	8.611	27.08	34.42	64.66	11.59	27.85	11.57	26.38	46.23	17		
15.32	8.670	29.69	8.657	28.74	34.60	65.50	11.65	29.52	11.62	28.04	46.44	18		
16.16	8.716	31.35	8.703	30.40	34.78	66.34	11.70	31.18	11.68	29.69	46.65	19		
316.99	8.762	633.02	8.749	632.05	34.97	367.17	11.75	732.84	11.73	731.34	46.87	20		
17.83	8.808	34.68	8.795	33.71	35.15	66.01	11.81	34.51	11.78	33.00	47.08	21		
18.67	8.855	36.35	8.841	35.37	35.34	66.85	11.86	36.17	11.84	34.65	47.29	22		
19.50	8.901	38.01	8.887	37.02	35.52	67.68	11.91	37.83	11.89	36.30	47.51	23		
20.34	8.948	39.68	8.934	38.68	35.71	68.52	11.97	39.50	11.94	37.95	47.72	24		
21.17	8.995	41.34	8.981	40.33	35.89	69.36	12.02	41.16	12.00	39.61	47.94	25		
22.01	9.041	43.00	9.027	41.99	36.08	70.19	12.08	42.82	12.05	41.26	48.15	26		
22.85	9.088	44.67	9.074	43.65	36.27	71.03	12.13	44.48	12.10	42.91	48.37	27		
23.68	9.135	46.33	9.121	45.30	36.45	71.87	12.18	46.15	12.16	44.56	48.58	28		
24.52	9.183	48.00	9.168	46.96	36.64	72.70	12.24	47.81	12.21	46.22	48.80	29		
325.35	9.230	649.66	9.215	648.62	36.83	375.54	12.29	749.47	12.27	747.87	49.02	30		
26.19	9.278	51.32	9.263	50.27	37.02	76.38	12.35	51.14	12.32	49.52	49.24	31		
27.03	9.325	52.99	9.310	51.93	37.21	77.21	12.40	52.80	12.38	51.17	49.45	32		
27.86	9.373	54.65	9.358	53.58	37.40	78.05	12.46	54.46	12.43	52.83	49.67	33		
28.70	9.421	56.32	9.405	55.24	37.59	78.89	12.51	56.13	12.49	54.48	49.89	34		
29.53	9.469	57.98	9.453	56.89	37.78	79.73	12.57	57.79	12.54	56.13	50.11	35		
30.37	9.517	59.64	9.501	58.55	37.97	80.56	12.62	59.45	12.60	57.78	50.33	36		
31.21	9.565	61.31	9.549	60.21	38.16	81.40	12.68	61.12	12.65	59.43	50.55	37		
32.04	9.613	62.97	9.597	61.86	38.36	82.24	12.74	62.78	12.71	61.09	50.77	38		
32.88	9.662	64.64	9.645	63.52	38.55	83.07	12.79	64.44	12.76	62.74	51.00	39		
333.71	9.710	666.30	9.694	665.17	38.74	383.91	12.85	766.10	12.82	764.39	51.22	40		
34.55	9.759	67.96	9.742	66.83	38.94	84.75	12.90	67.77	12.87	66.04	51.44	41		
35.39	9.808	69.63	9.791	68.48	39.13	85.59	12.96	69.43	12.93	67.69	51.66	42		
36.22	9.857	71.29	9.840	70.14	39.32	86.42	13.02	71.09	12.99	69.35	51.89	43		
37.06	9.906	72.95	9.888	71.79	39.52	87.26	13.07	72.76	13.04	71.00	52.11	44		
37.90	9.955	74.62	9.938	73.45	39.72	88.10	13.13	74.42	13.10	72.65	52.34	45		
38.73	10.005	76.28	9.987	75.10	39.91	88.94	13.19	76.08	13.16	74.30	52.56	46		
39.57	10.055	77.95	10.04	76.76	40.11	89.77	13.24	77.74	13.21	75.95	52.79	47		
40.40	10.105	79.61	10.09	78.41	40.31	90.61	13.30	79.41	13.27	77.60	53.01	48		
41.24	10.155	81.27	10.13	80.07	40.50	91.45	13.36	81.07	13.33	79.25	53.24	49		
342.08	10.205	682.94	10.18	681.72	40.70	392.28	13.41	782.83	13.38	780.91	53.46	50		
42.11	10.255	84.60	10.23	83.38	40.90	93.12	13.47	84.40	13.44	82.56	53.69	51		
43.75	10.305	86.26	10.28	85.03	41.10	93.96	13.53	86.06	13.50	84.21	53.92	52		
44.59	10.355	87.93	10.33	86.69	41.30	94.79	13.59	87.72	13.55	85.86	54.15	53		
45.42	10.405	89.59	10.38	88.34	41.50	95.63	13.64	89.38	13.61	87.51	54.38	54		
46.26	10.455	91.26	10.43	90.00	41.70	96.47	13.70	91.05	13.67	89.16	54.61	55		
47.09	10.505	92.92	10.48	91.65	41.90	97.31	13.76	92.71	13.73	90.81	54.84	56		
47.93	10.555	94.58	10.53	93.31	42.10	98.14	13.82	94.37	13.78	92.46	55.07	57		
48.77	10.605	96.25	10.59	94.96	42.30	98.98	13.87	96.04	13.84	94.11	55.30	58		
49.60	10.655	97.91	10.64	96.62	42.51	99.82	13.93	97.70	13.90	95.76	55.53	59		

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	8°						9°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	400.66	13.99	799.36	13.96	792.41	55.76	450.93	17.72	899.09	17.66	896.31	76.54
1	01.49	14.05	801.02	14.02	93.06	55.99	51.77	17.78	900.75	17.73	97.96	70.80
2	02.33	14.11	02.69	14.07	800.71	56.23	52.61	17.85	02.41	17.79	99.61	70.06
3	03.17	14.17	04.35	14.13	02.36	56.46	53.45	17.92	04.07	17.86	901.25	77.33
4	04.01	14.23	06.01	14.19	04.01	56.69	54.29	17.98	05.73	17.93	02.90	71.59
5	04.84	14.28	07.67	14.25	05.66	56.92	55.13	18.05	07.39	17.99	04.54	71.85
6	05.68	14.34	09.34	14.31	07.31	57.16	55.96	18.11	09.06	18.06	06.19	72.11
7	06.52	14.40	11.00	14.37	08.96	57.40	56.80	18.18	10.72	18.12	07.84	72.38
8	07.36	14.46	12.66	14.43	10.61	57.63	57.64	18.25	12.38	18.19	09.48	72.64
9	08.19	14.52	14.32	14.49	12.26	57.87	58.48	18.31	14.04	18.26	11.13	72.91
10	409.03	14.58	815.99	14.54	813.91	58.10	459.32	18.38	915.70	18.32	912.77	73.17
11	09.87	14.64	17.65	14.60	15.56	58.34	60.16	18.45	17.36	18.39	14.42	73.44
12	10.71	14.70	19.31	14.66	17.21	58.58	61.00	18.52	19.02	18.46	16.06	73.70
13	11.54	14.76	20.97	14.72	18.86	58.82	61.84	18.58	20.68	18.52	17.71	73.97
14	12.38	14.82	22.64	14.78	20.51	59.06	62.67	18.65	22.35	18.59	19.35	74.24
15	13.22	14.88	24.30	14.84	22.16	59.29	63.51	18.72	24.01	18.66	21.00	74.51
16	14.06	14.94	25.96	14.90	23.81	59.53	64.35	18.79	25.67	18.72	22.64	74.77
17	14.89	15.00	27.62	14.96	25.46	59.77	65.19	18.85	27.33	18.79	24.29	75.04
18	15.73	15.06	29.29	15.02	27.11	60.01	66.03	18.92	28.99	18.86	25.93	75.31
19	16.57	15.12	30.95	15.08	28.76	60.25	66.87	18.99	30.65	18.93	27.58	75.58
20	417.41	15.18	832.61	15.14	830.41	60.50	467.71	19.06	932.31	19.00	929.22	75.85
21	18.25	15.25	34.27	15.20	32.06	60.74	67.55	19.13	33.97	19.06	30.87	76.12
22	19.08	15.31	35.93	15.27	33.71	60.98	68.39	19.19	35.63	19.13	32.51	76.39
23	19.92	15.37	37.60	15.33	35.36	61.22	69.22	19.26	37.29	19.20	34.16	76.66
24	20.76	15.43	39.26	15.39	37.00	61.47	70.06	19.33	38.96	19.27	35.80	76.94
25	21.60	15.49	40.92	15.45	38.65	61.71	70.90	19.40	40.62	19.33	37.44	77.21
26	22.43	15.55	42.58	15.51	40.30	61.95	71.74	19.47	42.28	19.40	39.09	77.48
27	23.27	15.61	44.24	15.57	41.95	62.20	72.58	19.54	43.94	19.47	40.73	77.76
28	24.11	15.67	45.91	15.63	43.60	62.44	73.42	19.61	45.60	19.54	42.38	78.03
29	24.95	15.74	47.57	15.69	45.25	62.69	74.26	19.68	47.26	19.61	44.02	78.30
30	425.79	15.80	849.23	15.76	846.90	62.94	476.10	19.75	948.92	19.68	945.67	78.58
31	26.62	15.86	50.89	15.82	48.94	63.18	75.94	19.82	50.59	19.75	47.31	78.85
32	27.46	15.92	52.56	15.88	50.59	63.43	76.78	19.89	52.25	19.82	48.95	79.13
33	28.30	15.99	54.22	15.94	52.24	63.68	77.61	19.96	53.91	19.89	50.60	79.41
34	29.14	16.05	55.88	16.00	53.89	63.92	78.45	20.03	55.57	19.96	52.24	79.68
35	29.98	16.11	57.54	16.07	55.54	64.17	79.29	20.10	57.23	20.03	53.88	79.96
36	30.81	16.17	59.20	16.13	57.19	64.42	80.13	20.17	58.89	20.09	55.53	80.24
37	31.65	16.24	60.87	16.19	58.84	64.67	80.97	20.24	60.55	20.16	57.17	80.52
38	32.49	16.30	62.53	16.25	60.49	64.92	81.81	20.31	62.21	20.23	58.81	80.79
39	33.33	16.36	64.19	16.32	62.13	65.17	82.65	20.38	63.87	20.30	60.46	81.07
40	434.17	16.43	865.85	16.38	863.38	65.42	484.49	20.45	965.53	20.37	962.10	81.35
41	35.01	16.49	67.51	16.44	65.02	65.67	83.33	20.52	67.19	20.44	63.74	81.63
42	35.84	16.55	69.18	16.51	66.67	65.93	84.17	20.59	68.85	20.52	65.39	81.91
43	36.68	16.62	70.84	16.57	68.32	66.18	85.01	20.66	70.51	20.59	67.03	82.20
44	37.52	16.68	72.50	16.63	69.97	66.43	85.85	20.73	72.18	20.66	68.67	82.48
45	38.36	16.74	74.16	16.70	71.61	66.68	86.69	20.80	73.84	20.73	70.31	82.76
46	39.20	16.81	75.82	16.76	73.26	66.94	87.53	20.87	75.50	20.80	71.96	83.04
47	40.03	16.87	77.48	16.82	74.91	67.19	88.37	20.95	77.16	20.87	73.60	83.32
48	40.87	16.94	79.15	16.89	76.56	67.45	89.21	21.02	78.82	20.94	75.24	83.61
49	41.71	17.00	80.81	16.95	78.20	67.70	90.04	21.09	80.48	21.01	76.88	83.89
50	442.55	17.07	882.47	17.01	879.85	67.96	492.88	21.16	982.14	21.08	978.53	84.18
51	43.39	17.13	84.13	17.08	81.50	68.21	93.72	21.23	83.80	21.15	80.17	84.46
52	44.23	17.19	85.79	17.14	83.14	68.47	94.56	21.30	85.46	21.23	81.81	84.75
53	45.06	17.26	87.46	17.21	84.79	68.73	95.40	21.38	87.12	21.30	83.45	85.03
54	45.90	17.32	89.12	17.27	86.44	68.99	96.24	21.45	88.78	21.37	85.09	85.32
55	46.74	17.39	90.78	17.34	88.08	69.24	97.08	21.52	90.44	21.44	86.74	85.61
56	47.58	17.46	92.44	17.40	89.73	69.50	97.92	21.59	92.10	21.51	88.38	85.90
57	48.42	17.52	94.10	17.47	91.38	69.76	98.76	21.67	93.76	21.59	90.02	86.18
58	49.26	17.59	95.76	17.53	93.02	70.02	99.60	21.74	95.42	21.66	91.66	86.47
59	50.09	17.65	97.42	17.60	94.67	70.28	100.44	21.81	97.08	21.73	93.30	86.76

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

15

10°						11°						P
T	E	C	M	X	Y	T	E	C	M	X	Y	
501.28	21.89	998.74	21.80	994.94	87.05	557.70	26.50	1098.3	26.18	1093.3	105.27	0
02.12	21.96	1000.4	21.88	96.58	87.34	52.54	26.58	1100.0	26.46	94.9	05.59	1
04.96	22.03	02.1	21.95	98.23	87.63	53.38	26.66	01.6	26.54	96.5	05.91	2
03.80	22.11	01.7	22.02	99.87	87.92	54.23	26.74	01.3	26.62	98.2	06.23	3
08.64	22.18	05.4	22.09	1001.5	88.21	55.07	26.82	05.0	26.70	99.8	06.55	4
05.48	22.25	07.1	22.17	03.1	88.50	55.91	26.90	06.6	26.78	1101.4	06.87	5
06.32	22.33	08.7	22.24	04.8	88.79	56.75	26.99	08.3	26.86	03.1	07.19	6
07.16	22.40	10.4	22.31	06.4	89.08	57.59	27.07	09.9	26.94	04.7	07.51	7
08.00	22.48	12.0	22.39	08.1	89.38	58.43	27.15	11.6	27.02	06.4	07.83	8
08.84	22.55	13.7	22.46	09.7	89.67	59.27	27.23	13.3	27.10	08.0	08.15	9
509.68	22.62	1015.3	22.54	1011.4	89.96	560.11	27.31	1114.9	27.18	1109.6	108.47	10
10.52	22.70	17.0	22.61	13.0	90.26	60.96	27.39	16.6	27.26	11.3	08.80	11
11.36	22.77	18.7	22.68	14.6	90.55	61.80	27.48	18.2	27.35	12.9	09.12	12
12.20	22.85	20.3	22.76	16.3	90.85	62.64	27.56	19.9	27.43	14.5	09.44	13
13.04	22.92	22.0	22.83	17.9	91.14	63.48	27.64	21.5	27.51	16.2	09.77	14
13.88	23.00	23.6	22.91	19.6	91.44	64.32	27.72	23.2	27.59	17.8	10.09	15
14.72	23.07	25.3	22.98	21.2	91.74	65.16	27.81	24.9	27.67	19.4	10.42	16
15.56	23.15	27.0	23.06	22.9	92.04	66.00	27.89	26.5	27.75	21.1	10.74	17
16.40	23.22	28.6	23.13	24.5	92.33	66.85	27.97	28.2	27.84	22.7	11.07	18
17.24	23.30	30.3	23.20	26.1	92.63	67.69	28.05	29.8	27.92	24.3	11.40	19
518.08	23.37	1031.9	23.28	1027.8	92.93	568.53	28.14	1131.5	28.00	1126.0	111.73	20
18.92	23.45	31.6	23.35	27.4	93.23	69.37	28.22	33.2	28.08	27.6	12.05	21
19.76	23.53	33.3	23.43	31.0	93.53	70.21	28.30	34.8	28.16	29.2	12.38	22
20.60	23.60	36.9	23.51	32.7	93.83	71.05	28.39	36.5	28.25	30.9	12.71	23
21.44	23.68	38.6	23.58	34.3	94.13	71.90	28.47	38.1	28.33	32.5	13.04	24
22.28	23.75	40.2	23.66	36.0	94.43	72.74	28.55	39.8	28.41	34.1	13.37	25
23.12	23.83	41.9	23.73	37.6	94.73	73.58	28.64	41.5	28.50	35.8	13.70	26
23.96	23.91	43.6	23.81	39.2	95.03	74.42	28.72	43.1	28.58	37.4	14.03	27
24.80	23.98	45.2	23.88	40.9	95.34	75.26	28.81	44.8	28.66	39.0	14.36	28
25.64	24.06	46.9	23.96	42.5	95.64	76.10	28.89	46.4	28.75	40.7	14.69	29
526.48	24.14	1048.5	24.04	1044.1	95.94	576.95	28.97	1148.1	28.83	1142.3	115.02	30
27.32	24.21	50.2	24.11	45.8	96.25	77.79	29.06	49.7	28.91	43.9	15.36	31
28.16	24.29	51.9	24.19	47.4	96.55	78.63	29.14	51.4	29.00	45.6	15.69	32
29.00	24.37	53.5	24.27	49.1	96.86	79.47	29.23	53.1	29.08	47.2	16.02	33
29.84	24.45	55.2	24.34	50.7	97.16	80.31	29.31	54.7	29.16	48.8	16.36	34
30.68	24.52	56.8	24.42	52.3	97.47	81.15	29.40	56.4	29.25	50.5	16.69	35
31.52	24.60	58.5	24.50	54.0	97.77	82.00	29.48	58.0	29.33	52.1	17.03	36
32.36	24.68	60.2	24.57	55.6	98.08	82.84	29.57	59.7	29.42	53.7	17.36	37
33.20	24.76	61.8	24.65	57.3	98.39	83.68	29.65	61.3	29.50	55.4	17.70	38
34.05	24.83	63.5	24.73	58.9	98.70	84.52	29.74	63.0	29.58	57.0	18.03	39
534.89	24.91	1065.1	24.80	1060.5	99.00	585.36	29.82	1164.7	29.67	1158.6	18.37	40
35.73	24.99	66.8	24.88	62.2	99.31	86.21	29.91	66.3	29.75	60.3	18.71	41
36.57	25.07	68.5	24.96	63.8	99.62	87.05	30.00	68.0	29.84	61.9	19.05	42
37.41	25.15	70.1	25.04	65.4	99.93	87.89	30.08	69.6	29.92	63.5	19.38	43
38.25	25.23	71.8	25.12	67.1	100.24	88.73	30.17	71.3	30.01	65.2	19.72	44
39.09	25.30	73.4	25.19	68.7	00.55	89.58	30.25	73.0	30.09	66.8	20.06	45
39.93	25.38	75.1	25.27	70.4	00.86	90.42	30.34	74.6	30.18	68.4	20.40	46
40.77	25.46	76.8	25.35	72.0	01.18	91.26	30.43	76.3	30.27	70.1	20.74	47
41.61	25.54	78.4	25.43	73.6	01.49	92.10	30.51	77.9	30.35	71.7	21.08	48
42.45	25.62	80.1	25.51	75.3	01.80	92.94	30.60	79.6	30.44	73.3	21.42	49
543.29	25.70	1081.7	25.59	1076.9	102.11	593.79	30.69	1181.2	30.52	1175.0	21.77	50
44.13	25.78	81.4	25.64	76.5	02.43	94.63	30.77	82.9	30.61	76.6	22.11	51
44.97	25.86	85.1	25.72	80.2	02.74	95.47	30.86	84.6	30.69	78.2	22.45	52
45.82	25.94	86.7	25.82	81.8	03.06	96.31	30.95	86.2	30.78	79.8	22.79	53
46.66	26.02	88.4	25.90	83.5	03.37	97.16	31.03	87.9	30.87	81.5	23.14	54
47.50	26.10	90.0	25.98	85.1	03.69	98.00	31.12	89.5	30.95	83.1	23.48	55
48.34	26.18	91.7	26.06	86.7	04.00	98.84	31.21	91.2	31.04	84.7	23.82	56
49.18	26.26	93.3	26.14	88.4	04.32	99.68	31.30	92.9	31.13	86.4	24.17	57
50.02	26.34	95.0	26.22	90.0	04.63	100.53	31.38	94.6	31.21	88.0	24.52	58
50.86	26.42	96.7	26.30	91.6	04.95	01.37	31.47	96.2	31.30	89.6	24.86	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	12°						13°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	602.21	31.56	1197.8	31.39	1191.3	125.21	652.81	37.07	1297.2	36.83	1288.9	146.85
1	03.05	31.65	99.5	31.47	92.9	25.55	53.66	37.16	98.9	36.93	90.5	47.23
2	03.90	31.74	1201.1	31.56	94.5	25.90	54.50	37.26	1300.5	37.02	92.1	47.60
3	04.74	31.83	02.8	31.65	96.2	26.25	55.34	37.36	02.2	37.11	93.8	47.98
4	05.58	31.91	04.5	31.74	97.8	26.60	56.19	37.45	03.9	37.21	95.4	48.35
5	06.42	32.00	06.1	31.82	99.4	26.95	57.03	37.55	05.5	37.30	97.0	48.73
6	07.27	32.09	07.8	31.91	1201.0	27.29	57.88	37.64	07.2	37.40	98.6	49.11
7	08.11	32.18	09.4	32.00	02.7	27.64	58.72	37.74	08.8	37.49	100.3	49.49
8	08.95	32.27	11.1	32.09	04.3	27.99	59.57	37.84	10.5	37.59	01.9	49.87
9	08.79	32.36	12.7	32.18	05.9	28.34	60.41	37.93	12.1	37.68	03.5	50.24
10	610.64	32.45	1214.4	32.26	1207.6	128.70	661.25	38.03	1313.8	37.78	1305.1	150.62
11	11.48	32.54	16.1	32.35	09.2	29.05	62.10	38.13	15.4	37.88	06.7	51.00
12	12.32	32.63	17.7	32.44	10.8	29.40	62.94	38.23	17.1	37.97	08.4	51.38
13	13.17	32.72	19.4	32.53	12.4	29.75	63.79	38.32	18.8	38.07	10.0	51.76
14	14.01	32.81	21.0	32.62	14.1	30.10	64.63	38.42	20.4	38.16	11.6	52.15
15	14.85	32.90	22.7	32.71	15.7	30.46	65.48	38.52	22.1	38.26	13.2	52.53
16	15.69	32.99	24.3	32.80	17.3	30.81	66.32	38.61	23.7	38.36	14.9	52.91
17	16.54	33.08	26.0	32.89	19.0	31.17	67.17	38.71	25.4	38.45	16.5	53.29
18	17.38	33.17	27.7	32.98	20.6	31.52	68.01	38.81	27.0	38.55	18.1	53.68
19	18.22	33.26	29.3	33.06	22.2	31.88	68.86	38.91	28.7	38.65	19.7	54.06
20	619.07	33.35	1231.0	33.15	1223.8	132.21	669.70	39.01	1330.3	38.74	1321.3	154.44
21	19.91	33.44	32.6	33.24	23.5	32.29	70.74	39.10	32.0	38.84	23.0	54.83
22	20.75	33.53	34.3	33.33	27.1	32.94	71.39	39.20	33.7	38.94	24.6	55.21
23	21.60	33.62	35.9	33.42	28.7	33.30	72.23	39.30	35.3	39.03	26.2	55.60
24	22.44	33.71	37.6	33.51	30.4	33.66	73.08	39.40	37.0	39.13	27.8	55.98
25	23.28	33.80	39.3	33.60	32.0	34.02	73.92	39.50	38.6	39.23	29.5	56.37
26	24.13	33.89	40.9	33.69	33.6	34.38	74.77	39.60	40.3	39.32	31.1	56.76
27	24.97	33.98	42.6	33.78	35.2	34.74	75.61	39.70	41.9	39.42	32.7	57.15
28	25.81	34.08	44.2	33.87	36.9	35.10	76.46	39.79	43.6	39.52	34.3	57.53
29	26.66	34.17	45.9	33.96	38.5	35.46	77.30	39.89	45.2	39.62	35.9	57.92
30	627.50	34.26	1247.5	34.06	1240.1	135.82	678.15	39.99	1346.9	39.72	1337.6	158.31
31	28.34	34.35	49.2	34.15	41.8	36.18	78.99	40.09	48.6	39.81	39.2	58.70
32	29.19	34.44	50.9	34.24	43.4	36.54	79.84	40.19	50.2	39.91	40.8	59.09
33	30.03	34.53	52.5	34.33	45.0	36.90	80.68	40.29	51.9	40.01	42.4	59.48
34	30.87	34.63	54.2	34.42	46.6	37.26	81.53	40.39	53.5	40.11	44.0	59.87
35	31.72	34.72	55.8	34.51	48.3	37.63	82.37	40.49	55.2	40.21	45.7	60.26
36	32.56	34.81	57.5	34.60	49.9	37.99	83.22	40.59	56.8	40.31	47.3	60.65
37	33.40	34.90	59.1	34.69	51.5	38.35	84.06	40.69	58.5	40.40	48.9	61.05
38	34.25	35.00	60.8	34.78	53.1	38.72	84.91	40.79	60.1	40.50	50.5	61.44
39	35.09	35.09	62.4	34.88	54.8	39.08	85.76	40.89	61.8	40.60	52.1	61.83
40	635.93	35.18	1264.1	34.97	1256.4	139.45	686.60	40.99	1363.4	40.70	1353.8	162.23
41	36.78	35.28	65.8	35.06	58.0	39.81	87.45	41.09	65.1	40.80	55.4	62.62
42	37.62	35.37	67.4	35.15	59.6	40.18	88.29	41.19	66.8	40.90	57.0	63.01
43	38.46	35.46	69.1	35.24	61.3	40.55	89.14	41.29	68.4	41.00	58.6	63.41
44	39.31	35.56	70.7	35.34	62.9	40.91	89.98	41.40	70.1	41.10	60.2	63.80
45	40.15	35.65	72.4	35.43	64.5	41.28	90.83	41.50	71.7	41.20	61.9	64.20
46	41.00	35.74	74.0	35.52	66.1	41.65	91.67	41.60	73.4	41.30	63.5	64.60
47	41.84	35.84	75.7	35.61	67.8	42.02	92.52	41.70	75.0	41.40	65.1	65.00
48	42.68	35.93	77.4	35.71	69.4	42.39	93.36	41.80	76.7	41.50	66.7	65.39
49	43.53	36.03	79.0	35.80	71.0	42.76	94.21	41.90	78.3	41.60	68.3	65.79
50	644.37	36.12	1280.7	35.89	1272.6	143.13	695.06	42.00	1380.0	41.70	1370.0	166.19
51	45.21	36.21	82.3	35.99	74.3	43.50	95.90	42.11	81.6	41.80	71.6	66.59
52	46.06	36.31	84.0	36.08	75.9	43.87	96.75	42.21	83.3	41.90	73.2	66.98
53	46.90	36.40	85.6	36.17	77.5	44.24	97.59	42.31	85.0	42.00	74.8	67.38
54	47.75	36.50	87.3	36.27	79.1	44.61	98.44	42.41	86.6	42.10	76.4	67.78
55	48.59	36.59	88.9	36.36	80.8	44.98	99.28	42.51	88.3	42.20	78.0	68.18
56	49.43	36.69	90.6	36.45	82.4	45.35	100.13	42.62	89.9	42.30	79.7	68.59
57	50.28	36.78	92.3	36.55	84.0	45.73	100.98	42.72	91.6	42.40	81.3	68.99
58	51.12	36.88	93.9	36.64	85.6	46.10	101.82	42.82	93.2	42.50	82.9	69.39
59	51.97	36.97	95.6	36.74	87.3	46.48	102.67	42.93	94.9	42.61	84.5	69.79



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

17

14°						15°						I
T	E	C	M	X	Y	T	E	C	M	X	Y	
703.51	43.03	1396.5	42.71	1386.1	170.20	754.32	49.44	1495.7	49.02	1482.9	195.23	0
04.36	43.13	98.2	42.81	87.7	70.60	33.17	49.55	97.4	49.13	84.6	95.66	1
05.20	43.24	99.8	42.91	89.4	71.00	56.02	49.66	99.0	49.24	86.2	96.10	2
06.05	43.34	1401.5	43.01	91.0	71.41	56.87	49.77	1500.7	49.34	87.8	96.53	3
06.90	43.44	03.2	43.12	92.6	71.81	57.71	49.88	02.3	49.45	89.4	96.94	4
07.74	43.55	04.8	43.22	94.2	72.22	58.56	50.00	04.0	49.56	91.0	97.40	5
08.59	43.65	06.5	43.32	95.8	72.62	59.41	50.11	05.7	49.67	92.6	97.83	6
09.43	43.75	08.1	43.42	97.4	73.03	60.26	50.22	07.3	49.78	94.2	98.26	7
10.28	43.86	09.8	43.52	99.1	73.44	61.11	50.33	09.0	49.89	95.8	98.70	8
11.13	43.96	11.4	43.63	1400.7	73.84	61.95	50.44	10.6	50.00	97.4	99.13	9
711.97	44.07	1413.1	43.73	1402.3	174.25	762.80	50.55	1512.3	50.11	1499.0	199.57	10
12.82	44.17	14.7	43.83	03.9	74.66	63.65	50.67	13.9	50.22	1520.6	200.01	11
13.67	44.27	16.4	43.94	05.5	75.07	64.50	50.78	15.6	50.33	02.3	00.44	12
14.51	44.38	18.0	44.04	07.1	75.48	65.35	50.89	17.2	50.44	03.9	00.88	13
15.36	44.48	19.7	44.14	08.8	75.89	66.20	51.00	18.9	50.55	05.5	01.32	14
16.20	44.59	21.3	44.24	10.4	76.30	67.04	51.12	20.5	50.66	07.1	01.76	15
17.05	44.69	23.0	44.35	12.0	76.71	67.89	51.23	22.2	50.77	08.7	02.19	16
17.90	44.80	24.7	44.45	13.6	77.12	68.74	51.34	23.8	50.88	10.3	02.63	17
18.74	44.90	26.3	44.56	15.2	77.53	69.59	51.45	25.5	51.00	11.9	03.07	18
19.59	45.01	28.0	44.66	16.8	77.94	70.44	51.57	27.1	51.11	13.5	03.51	19
720.44	45.12	1429.6	44.76	1418.4	178.35	771.29	51.68	1528.8	51.22	1515.1	203.95	20
21.28	45.22	31.3	44.87	20.1	78.77	72.13	51.79	30.4	51.33	16.7	04.39	21
22.13	45.33	32.9	44.97	21.7	79.18	72.98	51.91	32.1	51.44	18.3	04.84	22
22.98	45.43	34.6	45.08	23.3	79.59	73.83	52.02	33.7	51.55	19.9	05.28	23
23.82	45.54	36.2	45.18	24.9	80.01	74.68	52.13	35.4	51.66	21.5	05.72	24
24.67	45.65	37.9	45.28	26.5	80.42	75.53	52.25	37.0	51.77	23.2	06.16	25
25.52	45.75	39.5	45.39	28.1	80.84	76.38	52.36	38.7	51.89	24.8	06.61	26
26.36	45.86	41.2	45.49	29.7	81.25	77.23	52.47	40.3	52.00	26.4	07.05	27
27.21	45.96	42.8	45.60	31.4	81.67	78.07	52.59	42.0	52.11	28.0	07.49	28
28.06	46.07	44.5	45.70	33.0	82.09	78.92	52.70	43.6	52.22	29.6	07.94	29
729.90	46.18	1446.2	45.81	1434.6	182.50	779.77	52.82	1545.3	52.34	1531.2	208.38	30
29.75	46.28	47.8	45.91	36.2	82.91	80.62	52.93	46.9	52.45	32.8	08.33	31
30.60	46.38	49.5	46.02	37.8	83.34	81.47	53.05	48.6	52.56	34.4	08.78	32
31.44	46.50	51.1	46.12	39.4	83.76	82.32	53.16	50.3	52.67	36.0	09.22	33
32.29	46.61	52.8	46.23	41.0	84.18	83.17	53.28	51.9	52.79	37.6	10.17	34
33.14	46.71	54.4	46.34	42.7	84.60	84.02	53.39	53.6	52.90	39.2	10.62	35
33.99	46.82	56.1	46.44	44.3	85.02	84.86	53.51	55.2	53.01	40.8	11.07	36
34.83	46.93	57.7	46.55	45.9	85.44	85.71	53.62	56.9	53.12	42.4	11.51	37
35.68	47.04	59.4	46.65	47.5	85.86	86.56	53.74	58.5	53.24	44.0	11.96	38
36.53	47.15	61.0	46.76	49.1	86.28	87.41	53.85	60.2	53.35	45.6	12.41	39
739.37	47.25	1462.7	46.87	1450.7	186.70	788.26	53.97	1561.8	53.46	1547.2	212.86	40
38.22	47.36	64.3	46.97	52.3	87.12	89.11	54.08	63.5	53.58	48.8	13.31	41
39.07	47.47	66.0	47.08	53.9	87.54	89.96	54.20	65.1	53.69	50.4	13.76	42
39.92	47.58	67.6	47.19	55.6	87.97	90.81	54.32	66.8	53.81	52.1	14.21	43
40.76	47.69	69.3	47.29	57.2	88.39	91.66	54.43	68.4	53.92	53.7	14.67	44
41.61	47.80	70.9	47.40	58.9	88.82	92.51	54.55	70.1	54.03	55.3	15.12	45
42.44	47.90	72.6	47.51	60.4	89.24	93.36	54.67	71.7	54.15	56.9	15.57	46
43.30	48.01	74.3	47.61	62.0	89.67	94.21	54.78	73.4	54.26	58.5	16.02	47
44.15	48.12	75.9	47.72	63.6	90.09	95.05	54.90	75.0	54.38	60.1	16.48	48
45.00	48.23	77.6	47.83	65.2	90.52	95.90	55.02	76.7	54.49	61.7	16.93	49
749.85	48.34	1479.2	47.94	1466.8	190.94	796.75	55.13	1578.3	54.61	1563.3	217.39	50
46.69	48.45	80.9	48.04	68.4	91.37	97.60	55.25	80.0	54.72	64.9	17.84	51
47.54	48.56	82.5	48.15	70.1	91.80	98.45	55.37	81.6	54.84	66.5	18.30	52
48.39	48.67	84.2	48.26	71.7	92.23	99.30	55.48	83.3	54.95	68.1	18.75	53
49.24	48.78	85.8	48.37	73.3	92.65	100.15	55.60	84.9	55.07	69.7	19.21	54
50.08	48.89	87.5	48.48	74.9	93.08	101.00	55.72	86.6	55.18	71.3	19.67	55
50.93	49.00	89.1	48.58	76.5	93.51	101.85	55.84	88.2	55.30	72.9	20.12	56
51.78	49.11	90.8	48.69	78.1	93.94	102.70	55.96	89.9	55.41	74.5	20.58	57
52.63	49.22	92.4	48.80	79.7	94.37	103.55	56.07	91.5	55.53	76.1	21.04	58
53.48	49.33	94.1	48.91	81.3	94.80	104.40	56.19	93.2	55.64	77.7	21.50	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	16°						17°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	805.25	56.31	1594.8	55.76	1579.3	221.96	856.30	63.63	1693.8	62.94	1675.2	250.16
1	06.10	56.55	98.1	55.88	80.9	22.42	57.15	63.76	95.4	63.06	76.8	20.85
2	06.95	56.55	98.1	55.99	82.5	22.88	58.01	63.89	97.1	63.18	78.4	21.33
3	07.80	56.66	99.8	56.11	84.1	23.34	58.86	64.01	98.7	63.31	80.0	21.82
4	08.65	56.79	1601.4	56.23	85.7	23.80	59.71	64.14	1700.4	63.43	81.6	22.31
5	09.50	56.90	03.1	56.34	87.3	24.26	60.56	64.27	02.0	63.55	83.2	22.80
6	10.35	57.02	04.7	56.46	88.9	24.72	61.41	64.39	03.7	63.68	84.7	23.29
7	11.20	57.14	06.4	56.58	90.5	25.18	62.27	64.52	05.3	63.80	86.3	23.78
8	12.05	57.26	08.0	56.69	92.1	25.65	63.12	64.65	07.0	63.92	87.9	24.27
9	12.50	57.38	09.7	56.81	93.7	26.11	63.97	64.77	08.6	64.05	89.5	24.76
10	813.75	57.50	1611.3	56.93	1595.3	226.57	864.82	64.90	1710.3	64.17	1691.1	255.25
11	14.60	57.62	13.0	57.04	96.9	27.04	65.68	65.03	11.9	64.30	92.7	25.25
12	15.45	57.74	14.6	57.16	98.5	27.50	66.53	65.15	13.6	64.42	94.3	25.74
13	16.30	57.86	16.3	57.28	1600.1	27.97	67.38	65.28	15.2	64.55	95.9	26.23
14	17.15	57.98	17.9	57.40	01.7	28.43	68.23	65.41	16.9	64.67	97.5	26.72
15	18.00	58.10	19.6	57.51	03.3	28.90	69.09	65.54	18.5	64.80	99.1	27.21
16	18.85	58.22	21.2	57.63	04.9	29.37	69.94	65.67	20.2	64.92	1700.7	27.70
17	19.70	58.34	22.9	57.75	06.5	29.83	70.79	65.79	21.9	65.05	02.3	28.19
18	20.55	58.46	24.5	57.87	08.1	30.30	71.64	65.92	23.5	65.17	03.9	28.68
19	21.40	58.58	26.2	57.99	09.7	30.77	72.50	66.05	25.1	65.30	05.4	29.17
20	822.25	58.70	1621.8	58.10	1611.3	231.24	873.35	66.18	1726.8	65.42	1707.0	260.20
21	23.10	58.82	29.5	58.22	12.9	31.71	74.20	66.31	28.4	65.55	08.6	29.66
22	23.95	58.94	31.1	58.34	14.5	32.18	75.05	66.44	30.0	65.67	10.2	30.15
23	24.80	59.06	32.8	58.46	16.1	32.65	75.91	66.56	31.7	65.80	11.8	30.64
24	25.65	59.18	34.4	58.58	17.7	33.12	76.76	66.69	33.3	65.93	13.4	31.13
25	26.51	59.31	36.1	58.70	19.3	33.59	77.61	66.82	35.0	66.05	15.0	31.62
26	27.36	59.43	37.7	58.82	20.9	34.06	78.47	66.95	36.6	66.18	16.6	32.11
27	28.21	59.54	39.4	58.93	22.5	34.53	79.32	67.08	38.3	66.30	18.2	32.60
28	29.06	59.67	41.0	59.06	24.1	35.00	80.17	67.21	39.9	66.43	19.8	33.09
29	29.91	59.79	42.7	59.17	25.7	35.48	81.02	67.34	41.6	66.56	21.3	33.58
30	830.76	59.91	1644.3	59.29	1627.3	235.95	881.88	67.47	1743.2	66.68	1722.9	265.19
31	31.61	60.04	46.0	59.41	28.9	36.42	82.73	67.60	44.9	66.81	24.5	34.07
32	32.46	60.16	47.6	59.53	30.5	36.90	83.58	67.73	46.5	66.94	26.1	34.56
33	33.31	60.28	49.3	59.65	32.1	37.37	84.44	67.86	48.2	67.07	27.7	35.05
34	34.16	60.40	50.9	59.77	33.7	37.85	85.29	67.99	49.8	67.19	29.3	35.54
35	35.01	60.53	52.6	59.89	35.3	38.32	86.14	68.12	51.5	67.32	30.9	36.03
36	35.87	60.65	54.2	60.01	36.9	38.80	87.00	68.25	53.1	67.45	32.5	36.52
37	36.72	60.77	55.9	60.13	38.5	39.27	87.85	68.38	54.8	67.57	34.1	37.01
38	37.57	60.89	57.5	60.25	40.1	39.75	88.70	68.51	56.4	67.70	35.7	37.50
39	38.42	61.02	59.2	60.38	41.7	40.23	89.56	68.64	58.1	67.83	37.2	37.99
40	839.27	61.14	1660.8	60.50	1643.3	240.71	896.41	68.77	1759.7	67.96	1738.8	270.22
41	40.12	61.26	62.5	60.62	44.9	41.18	91.26	68.91	61.3	68.09	40.4	38.48
42	40.97	61.39	64.1	60.74	46.5	41.66	92.12	69.04	63.0	68.21	42.0	38.97
43	41.82	61.51	65.8	60.86	48.1	42.14	92.97	69.17	64.6	68.34	43.6	39.46
44	42.68	61.64	67.4	60.98	49.7	42.62	93.82	69.30	66.3	68.47	45.2	39.95
45	43.53	61.76	69.1	61.10	51.3	43.10	94.68	69.43	67.9	68.60	46.8	40.44
46	44.38	61.88	70.7	61.22	52.9	43.58	95.53	69.56	69.6	68.73	48.4	40.93
47	45.23	62.01	72.4	61.34	54.5	44.06	96.39	69.69	71.2	68.86	49.9	41.42
48	46.08	62.13	74.0	61.47	56.1	44.54	97.24	69.83	72.9	68.99	51.5	41.91
49	46.93	62.26	75.7	61.59	57.6	45.03	98.09	69.96	74.5	69.11	53.1	42.40
50	847.78	62.38	1677.3	61.71	1659.2	245.51	898.95	70.09	1776.2	69.24	1754.7	275.30
51	48.64	62.51	78.0	61.83	60.8	45.99	99.80	70.22	75.8	69.37	54.7	42.89
52	49.49	62.63	80.6	61.95	62.4	46.48	100.65	70.36	77.5	69.50	56.3	43.38
53	50.34	62.76	82.3	62.08	64.0	46.96	01.51	70.49	79.1	69.63	57.9	43.87
54	51.19	62.88	83.9	62.20	65.6	47.44	02.36	70.62	80.8	69.76	59.5	44.36
55	52.04	63.01	85.5	62.32	67.2	47.93	03.22	70.75	82.4	69.89	61.1	44.85
56	52.89	63.13	87.2	62.44	68.8	48.41	04.07	70.89	84.0	70.02	62.7	45.34
57	53.75	63.26	88.8	62.57	70.4	48.90	04.92	71.02	85.7	70.15	64.3	45.83
58	54.60	63.38	90.5	62.69	72.0	49.38	05.78	71.15	87.3	70.28	65.9	46.32
59	55.45	63.51	92.1	62.81	73.6	49.87	06.63	71.29	89.0	70.41	67.5	46.81

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

19

18°						19°						P
T	E	C	M	X	Y	T	E	C	M	X	Y	
907.49	71.42	1792.6	7054	1770.6	290.43	958.81	79.67	1891.3	78.58	1865.4	312.16	0
08.34	71.53	94.3	70.67	72.1	80.94	59.67	79.81	91.0	78.72	67.0	12.70	1
09.20	71.69	95.9	70.80	73.7	81.46	60.53	79.95	94.6	78.85	68.5	13.25	2
10.05	71.82	97.6	70.93	75.3	81.98	61.38	80.10	96.3	78.99	70.1	13.79	3
10.90	71.96	99.2	71.06	76.9	82.49	62.24	80.24	97.9	79.13	71.7	14.33	4
11.76	72.09	1800.9	71.19	78.5	83.01	63.10	80.38	99.5	79.27	73.3	14.88	5
12.61	72.22	02.5	71.33	80.1	83.53	63.96	80.52	1901.2	79.41	74.8	15.42	6
13.47	72.36	04.2	71.46	81.7	84.05	64.81	80.66	02.8	79.54	76.4	15.97	7
14.32	72.49	05.8	71.59	83.2	84.57	65.67	80.81	04.5	79.68	78.0	16.51	8
15.18	72.63	07.4	71.72	84.8	85.08	66.53	80.95	06.1	79.82	79.6	17.06	9
916.03	72.76	1809.1	71.85	1786.4	285.60	967.38	81.09	1907.8	79.96	1881.1	317.61	10
16.89	72.90	10.7	71.98	88.0	86.12	68.24	81.23	09.4	80.10	82.7	18.16	11
17.74	73.03	12.4	72.11	89.6	86.64	69.10	81.38	11.1	80.24	84.3	18.70	12
18.60	73.17	14.0	72.25	91.2	87.16	69.96	81.52	12.7	80.38	85.9	19.25	13
19.45	73.30	15.7	72.38	92.7	87.68	70.81	81.66	14.3	80.52	87.4	19.80	14
20.31	73.44	17.3	72.51	94.3	88.21	71.67	81.81	16.0	80.66	89.0	20.35	15
21.16	73.58	19.0	72.64	95.9	88.73	72.53	81.95	17.6	80.79	90.6	20.90	16
22.02	73.71	20.6	72.78	97.5	89.25	73.38	82.09	19.3	80.93	92.2	21.45	17
22.87	73.85	22.3	72.91	99.1	89.77	74.24	82.24	20.9	81.07	93.7	22.00	18
23.73	73.98	23.9	73.04	1800.6	90.30	75.10	82.38	22.6	81.21	95.3	22.55	19
924.58	74.12	1825.6	73.17	1802.2	290.82	975.96	82.53	1924.2	81.35	1896.9	323.10	20
25.44	74.26	27.2	73.31	03.8	91.35	76.81	82.67	25.8	81.49	98.5	23.66	21
26.29	74.39	28.8	73.44	05.4	91.87	77.67	82.81	27.5	81.63	1900.0	24.21	22
27.15	74.53	30.5	73.57	07.0	92.40	78.53	82.96	29.1	81.77	01.6	24.76	23
28.00	74.67	32.1	73.70	08.6	92.92	79.39	83.10	30.8	81.91	03.2	25.31	24
28.86	74.80	33.8	73.84	10.1	93.45	80.24	83.25	32.4	82.05	04.7	25.87	25
29.71	74.94	35.4	73.97	11.7	93.98	81.10	83.39	34.1	82.20	06.3	26.42	26
30.57	75.08	37.1	74.11	13.3	94.50	81.96	83.54	35.7	82.34	07.9	26.98	27
31.42	75.21	38.7	74.24	14.9	95.03	82.82	83.68	37.3	82.48	09.5	27.53	28
32.28	75.35	40.4	74.37	16.5	95.56	83.68	83.83	39.0	82.62	11.0	28.09	29
933.13	75.49	1842.0	74.51	1818.0	296.09	984.53	83.97	1940.6	82.76	1912.6	328.64	30
33.99	75.63	43.6	74.64	18.6	96.62	85.39	84.12	42.3	82.90	14.2	29.20	31
34.84	75.76	45.3	74.77	21.2	97.15	86.25	84.26	43.9	83.04	15.7	29.76	32
35.70	75.90	46.9	74.91	22.8	97.68	87.11	84.41	45.6	83.18	17.3	30.32	33
36.55	76.04	48.6	75.04	24.4	98.21	87.97	84.55	47.2	83.32	18.9	30.87	34
37.41	76.18	50.2	75.18	25.9	98.74	88.82	84.70	48.8	83.47	20.5	31.43	35
38.27	76.32	51.9	75.31	27.5	99.27	89.68	84.85	50.5	83.61	22.0	31.99	36
39.12	76.45	53.5	75.45	29.1	99.80	90.54	84.99	52.1	83.75	23.6	32.55	37
39.98	76.59	55.2	75.58	30.7	100.33	91.40	85.14	53.8	83.89	25.2	33.11	38
40.83	76.73	56.8	75.72	32.3	100.87	92.26	85.28	55.4	84.03	26.7	33.67	39
941.69	76.87	1858.4	75.85	1833.8	301.40	993.12	85.43	1957.1	84.18	1928.3	334.23	40
42.55	77.01	60.1	75.99	35.4	01.93	93.97	85.58	58.7	84.32	29.9	34.79	41
43.40	77.15	61.7	76.12	37.0	02.47	94.83	85.72	60.3	84.46	31.4	35.35	42
44.26	77.29	63.4	76.26	38.6	03.00	95.69	85.87	62.0	84.60	33.0	35.92	43
45.11	77.43	65.0	76.39	40.2	03.54	96.55	86.02	63.6	84.75	34.6	36.48	44
45.97	77.57	66.7	76.53	41.7	04.07	97.41	86.17	65.3	84.89	36.1	37.04	45
46.83	77.70	68.3	76.66	43.3	04.61	98.27	86.31	66.9	85.03	37.7	37.60	46
47.68	77.84	70.0	76.80	44.9	05.14	99.13	86.46	68.5	85.18	39.3	38.17	47
48.54	77.98	71.6	76.94	46.5	05.68	99.98	86.61	70.2	85.32	40.8	38.73	48
49.39	78.12	73.2	77.07	48.0	06.22	100.8	86.76	71.8	85.46	42.4	39.30	49
950.25	78.26	1874.9	77.21	1849.6	306.76	1001.7	86.90	1973.5	85.61	1944.0	339.86	50
51.11	78.40	76.5	77.35	51.2	06.79	01.6	87.05	75.1	85.75	45.5	40.43	51
51.96	78.54	78.2	77.48	52.8	07.33	02.4	87.20	76.8	85.89	47.1	40.99	52
52.82	78.68	79.8	77.62	54.4	07.87	03.3	87.35	78.4	86.04	48.7	41.56	53
53.68	78.83	81.5	77.76	55.9	08.41	05.1	87.50	80.0	86.18	50.3	42.13	54
54.53	78.97	83.1	77.89	57.5	08.95	06.0	87.64	81.7	86.32	51.8	42.70	55
55.39	79.11	84.8	78.03	59.1	09.49	06.9	87.79	83.3	86.47	53.4	43.26	56
56.24	79.25	86.4	78.17	60.7	10.03	07.7	87.94	85.0	86.61	55.0	43.83	57
57.10	79.39	88.0	78.30	62.2	11.07	08.6	88.09	86.6	86.76	56.5	44.40	58
57.96	79.53	89.7	78.44	63.8	11.62	09.4	88.24	88.2	86.90	58.1	44.97	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	20°						21°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	1010.3	88.19	198.99	87.05	195.97	505.54	1061.9	97.58	2088.3	95.94	2053.3	380.56
1	11.2	88.54	91.5	87.9	61.2	46.11	62.8	97.77	89.9	96.10	54.9	81.16
2	12.0	88.69	93.2	87.34	62.8	46.48	63.7	97.89	91.6	96.25	56.4	81.76
3	12.9	88.84	94.8	87.48	64.4	47.25	64.5	98.05	93.2	96.40	58.0	82.35
4	13.7	88.99	96.5	87.63	65.9	47.82	65.4	98.21	94.8	96.55	59.5	82.95
5	14.6	89.14	98.1	87.77	67.5	48.46	66.2	98.36	96.5	96.70	61.1	83.55
6	15.4	89.29	99.7	87.92	69.1	49.07	67.1	98.52	98.1	96.86	62.7	84.15
7	16.3	89.44	2001.4	88.06	70.6	49.54	68.0	98.68	99.8	97.01	64.2	84.75
8	17.2	89.59	03.0	88.21	72.2	50.12	68.8	98.84	2101.4	97.16	65.8	85.35
9	18.0	89.74	04.7	88.35	73.7	50.69	69.7	99.00	03.0	97.32	67.3	85.95
10	1018.9	89.89	2006.3	88.50	1975.3	351.26	1070.6	99.15	2104.7	97.47	2068.9	386.56
11	19.7	90.04	07.9	88.65	76.9	51.84	71.4	99.31	06.3	97.62	70.4	87.16
12	20.6	90.19	09.6	88.79	78.4	52.41	72.3	99.47	08.0	97.77	72.0	87.76
13	21.5	90.34	11.2	88.94	80.0	52.99	73.1	99.63	09.6	97.93	73.5	88.36
14	22.3	90.49	12.9	89.08	81.6	53.57	74.0	99.79	11.2	98.08	75.1	88.97
15	23.2	90.64	14.5	89.23	83.1	54.14	74.9	99.95	12.9	98.23	76.6	89.57
16	24.0	90.79	16.1	89.38	84.7	54.72	75.7	100.11	14.5	98.39	78.2	90.18
17	24.9	90.94	17.8	89.52	86.3	55.30	76.6	00.27	16.1	98.54	79.7	90.78
18	25.8	91.10	19.4	89.67	87.8	55.87	77.5	00.43	17.8	98.70	81.3	91.38
19	26.6	91.25	21.1	89.82	89.4	56.45	78.3	00.59	19.4	98.85	82.9	91.99
20	1027.5	91.40	2022.7	89.96	1990.9	357.03	1079.2	100.75	2121.1	99.00	2084.4	392.60
21	28.3	91.55	24.3	90.11	92.5	57.61	80.0	00.91	22.7	99.16	86.0	93.20
22	29.2	91.70	26.0	90.26	94.1	58.19	80.9	01.07	24.3	99.31	87.5	93.81
23	30.1	91.86	27.6	90.41	95.6	58.77	81.8	01.23	26.0	99.47	89.1	94.42
24	30.9	92.01	29.3	90.55	97.2	59.35	82.6	01.39	27.6	99.62	90.6	95.03
25	31.8	92.16	30.9	90.70	98.8	59.9	83.5	01.55	29.2	99.78	92.2	95.63
26	32.6	92.31	32.5	90.85	2000.3	60.5	84.4	01.71	30.9	99.93	93.7	96.24
27	33.5	92.47	34.2	91.00	01.9	61.10	85.2	01.87	32.5	100.09	95.3	96.85
28	34.4	92.62	35.8	91.14	03.4	61.68	86.1	02.03	34.2	00.24	96.8	97.46
29	35.2	92.77	37.5	91.29	05.0	62.26	86.9	02.19	35.8	00.40	98.4	98.07
30	1036.1	92.92	2039.1	91.44	2006.6	362.85	1087.8	102.35	2137.4	100.55	2099.9	398.68
31	37.0	93.08	40.7	91.59	88.1	63.43	88.7	02.51	39.1	00.71	2101.5	99.29
32	37.8	93.23	42.4	91.74	89.7	64.01	89.5	02.67	40.7	00.86	01.0	99.91
33	38.7	93.38	44.0	91.89	91.2	64.60	90.4	02.83	42.3	01.02	02.6	100.52
34	39.5	93.54	45.7	92.04	92.8	65.18	91.3	02.99	44.0	01.18	06.1	01.13
35	40.4	93.69	47.3	92.18	94.4	65.77	92.1	03.16	45.6	01.33	07.7	01.74
36	41.3	93.85	48.9	92.33	95.9	66.36	93.0	03.32	47.3	01.49	09.2	02.36
37	42.1	94.00	50.6	92.48	97.5	66.94	93.9	03.48	48.9	01.64	10.8	02.97
38	43.0	94.15	52.2	92.63	99.0	67.53	94.7	03.64	50.5	01.80	12.3	03.58
39	43.8	94.31	53.9	92.78	20.6	68.12	95.6	03.80	52.2	01.96	13.9	04.20
40	1044.7	94.46	2055.5	92.93	2022.2	368.71	1096.4	103.97	2153.8	102.11	2115.4	404.81
41	45.6	94.62	57.1	93.08	23.7	69.29	97.3	04.13	55.4	02.17	17.0	05.43
42	46.4	94.77	58.8	93.23	25.3	69.88	98.2	04.29	57.1	02.43	18.5	06.05
43	47.3	94.93	60.4	93.38	26.8	70.47	99.0	04.45	58.7	02.58	20.1	06.66
44	48.1	95.08	62.1	93.53	28.4	71.06	99.9	04.61	60.4	02.74	21.6	07.28
45	49.0	95.24	63.7	93.68	30.0	71.65	1100.8	04.78	62.0	02.90	23.2	07.90
46	49.9	95.39	65.3	93.83	31.5	72.24	01.6	04.94	63.6	03.06	24.7	08.51
47	50.7	95.55	67.0	93.98	33.1	72.83	02.5	05.11	65.3	03.21	26.3	09.13
48	51.6	95.70	68.6	94.13	34.6	73.43	03.4	05.27	66.9	03.37	27.8	09.75
49	52.4	95.86	70.3	94.28	36.2	74.02	04.2	05.43	68.5	03.53	29.4	10.37
50	1053.3	96.01	2071.9	94.43	2037.8	374.61	1105.1	105.60	2170.2	103.69	2130.3	410.99
51	54.2	96.17	73.5	94.58	39.3	74.60	05.9	05.76	71.8	03.84	32.4	11.61
52	55.0	96.33	75.2	94.73	40.9	75.20	06.8	05.92	73.4	04.00	34.0	12.23
53	55.9	96.48	76.8	94.88	42.4	75.79	07.7	06.09	75.1	04.16	35.5	12.85
54	56.8	96.64	78.5	95.03	44.0	76.38	08.5	06.25	76.7	04.32	37.1	13.47
55	57.6	96.79	80.1	95.19	45.5	77.08	09.4	06.42	78.4	04.48	38.6	14.10
56	58.5	96.95	81.7	95.34	47.1	77.68	10.3	06.58	80.0	04.63	40.2	14.72
57	59.3	97.11	83.4	95.49	48.7	78.27	11.1	06.75	81.6	04.79	41.7	15.34
58	60.2	97.26	85.0	95.64	50.2	78.87	12.0	06.91	83.3	04.95	43.3	15.96
59	61.1	97.42	86.7	95.79	51.8	79.46	12.9	07.08	84.9	05.11	44.8	16.59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

22°							23°						
T	E	C	M	X	Y		T	E	C	M	X	Y	I
113.7	107.24	2186.5	105.27	2146.4	4-17.21	1165.7	117.38	2284.6	115.02	2238.8	455.48	0	
14.6	07.41	88.2	05.43	47.9	1783	66.6	1755	86.2	15.19	40.3	56.13	1	
15.5	07.57	89.8	05.59	49.5	1846	67.4	1773	87.9	15.36	41.8	56.78	2	
16.3	07.74	91.4	05.75	51.0	19.09	68.3	1790	89.5	15.52	43.4	57.43	3	
17.2	07.90	93.1	05.91	52.5	19.71	69.2	1807	91.1	15.69	44.9	58.09	4	
18.1	08.07	94.7	06.07	54.1	20.34	70.1	1825	92.8	15.86	46.4	58.74	5	
18.9	08.23	96.4	06.23	55.6	20.97	70.9	1842	94.4	16.02	48.0	59.39	6	
19.8	08.40	98.0	06.39	57.2	21.59	71.8	1860	96.0	16.19	49.5	60.05	7	
20.7	08.56	99.6	06.55	58.7	22.22	72.7	1877	97.7	16.36	51.0	60.70	8	
21.5	08.73	2201.3	06.71	60.3	22.85	73.5	1894	99.3	16.52	52.6	61.36	9	
112.4	108.90	2202.9	106.87	2161.8	423.48	1174.4	119.12	2300.9	116.69	2254.1	462.01	10	
23.2	09.06	04.5	07.03	63.4	24.11	75.3	19.29	02.6	16.86	55.6	62.67	11	
24.1	09.23	06.2	07.19	64.9	24.74	76.1	19.47	04.2	17.03	57.1	63.33	12	
25.0	09.40	07.8	07.35	66.4	25.37	77.0	19.64	05.8	17.19	58.7	63.98	13	
25.8	09.56	09.4	07.51	68.0	26.00	77.9	19.82	07.5	17.36	60.2	64.64	14	
26.7	09.73	11.1	07.67	69.5	26.63	78.7	19.99	09.1	17.53	61.7	65.30	15	
27.6	09.90	12.7	07.83	71.1	27.26	79.6	20.17	10.7	17.70	63.3	65.96	16	
28.4	10.06	14.3	07.99	72.6	27.89	80.5	20.34	12.4	17.87	64.8	66.62	17	
29.3	10.23	16.0	08.15	74.2	28.52	81.3	20.52	14.0	18.03	66.3	67.27	18	
30.2	10.40	17.6	08.31	75.7	29.15	82.2	20.69	15.6	18.20	67.9	67.93	19	
113.0	110.57	2219.2	108.87	2177.2	429.79	1183.1	120.87	2317.3	118.37	2269.4	468.59	20	
31.9	10.73	20.9	08.47	78.8	30.42	83.9	21.04	17.9	18.37	70.9	68.55	21	
32.8	10.90	22.5	08.60	80.3	31.05	84.8	21.22	19.5	18.53	72.5	69.21	22	
33.6	11.07	24.2	08.76	81.9	31.69	85.7	21.40	21.2	18.68	74.0	70.88	23	
34.5	11.24	25.8	08.92	83.4	32.32	86.6	21.57	22.8	18.85	75.5	71.54	24	
35.4	11.41	27.4	09.08	84.9	32.96	87.4	21.75	24.5	19.02	77.0	72.20	25	
36.2	11.58	29.1	09.24	86.5	33.60	88.3	21.92	26.1	19.18	78.6	72.86	26	
37.1	11.74	30.7	09.41	88.0	34.23	89.2	22.10	27.7	19.35	80.1	73.52	27	
38.0	11.91	32.3	09.57	89.6	34.87	90.0	22.28	29.3	19.52	81.6	74.18	28	
38.8	12.08	34.0	09.73	91.1	35.51	90.9	22.45	31.0	19.69	83.2	74.85	29	
113.7	112.25	2235.6	110.09	2192.6	436.14	1191.8	122.63	2333.6	120.06	2284.7	475.22	30	
40.6	12.42	37.2	10.26	94.2	36.78	92.6	22.81	35.2	20.23	86.2	75.68	31	
41.4	12.59	38.9	10.42	95.7	37.42	93.5	22.99	36.9	20.40	87.7	76.35	32	
42.3	12.76	40.5	10.58	97.3	38.06	94.4	23.16	38.5	20.57	89.3	77.01	33	
43.2	12.93	42.1	10.74	98.8	38.70	95.2	23.34	40.1	20.74	90.8	77.68	34	
44.0	13.10	43.8	10.91	100.3	39.34	96.1	23.52	41.8	20.91	92.3	78.35	35	
44.9	13.27	45.4	11.07	01.9	39.98	97.0	23.70	43.4	21.08	93.9	79.01	36	
45.8	13.44	47.0	11.23	03.4	40.62	97.9	23.87	45.0	21.25	95.4	79.68	37	
46.6	13.61	48.7	11.40	05.0	41.26	98.7	24.05	46.6	21.42	96.9	80.35	38	
47.5	13.78	50.3	11.56	06.5	41.90	99.6	24.23	48.3	21.59	98.4	81.02	39	
114.8	113.95	2251.9	111.73	2208.0	442.54	1200.5	124.41	2349.9	121.77	2300.0	481.88	40	
49.2	14.12	52.6	11.89	09.6	43.19	01.3	24.59	51.5	21.76	101.5	82.55	41	
50.1	14.29	55.2	12.05	11.1	43.83	02.2	24.77	53.2	22.11	103.0	83.22	42	
51.0	14.46	56.8	12.22	12.6	44.47	03.1	24.94	54.8	22.28	104.5	83.89	43	
51.8	14.63	58.5	12.38	14.2	45.12	03.9	25.12	56.4	22.45	106.1	84.56	44	
52.7	14.80	60.1	12.55	15.7	45.76	04.8	25.30	58.1	22.62	107.6	85.24	45	
53.6	14.97	61.7	12.71	17.3	46.41	05.7	25.48	59.7	22.79	109.1	85.91	46	
54.4	15.14	63.4	12.87	18.8	47.05	06.6	25.66	61.3	22.96	110.6	86.58	47	
55.3	15.31	65.0	13.04	20.3	47.70	07.4	25.84	63.0	23.14	112.2	87.25	48	
56.2	15.48	66.6	13.20	21.9	48.34	08.3	26.02	64.6	23.31	113.7	87.92	49	
115.0	115.66	2268.3	113.37	2223.4	448.99	1209.2	126.20	2366.2	123.48	2315.2	488.60	50	
57.9	15.83	69.9	13.53	24.9	49.64	10.0	26.38	67.8	23.65	115.7	89.27	51	
58.8	16.00	71.5	13.70	26.5	50.28	10.9	26.56	69.5	23.82	117.3	89.94	52	
59.6	16.17	73.2	13.86	28.0	50.93	11.8	26.74	71.1	24.00	118.8	90.62	53	
60.5	16.35	74.8	14.03	29.5	51.58	12.6	26.92	72.7	24.17	120.3	91.30	54	
61.4	16.52	76.5	14.20	31.1	52.23	13.5	27.10	74.4	24.34	121.8	91.97	55	
62.2	16.69	78.1	14.36	32.6	52.88	14.4	27.28	76.0	24.52	123.4	92.65	56	
63.1	16.86	79.7	14.53	34.1	53.53	15.3	27.46	77.6	24.69	125.0	93.32	57	
64.0	17.04	81.4	14.69	35.7	54.18	16.1	27.64	79.3	24.86	126.6	94.00	58	
64.8	17.21	83.0	14.86	37.2	54.83	17.0	27.82	80.9	25.03	128.2	94.68	59	

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	24°						25°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	12.179	12.800	23.82.5	12.5.21	23.30.5	495.35	12.70.2	13.9.11	24.80.2	13.5.82	24.21.5	536.82
1	18.7	28.19	84.2	25.38	32.0	96.03	71.1	39.30	81.9	36.00	23.0	37.53
2	18.6	28.37	85.8	25.55	33.5	96.71	72.0	39.49	83.5	36.18	24.5	38.23
3	20.5	28.55	87.4	25.73	35.0	97.39	72.9	39.68	85.1	36.36	26.0	38.94
4	21.4	28.73	89.0	25.90	36.5	98.07	73.7	39.87	86.8	36.54	27.5	39.64
5	22.2	28.91	90.7	26.07	38.1	98.75	74.6	40.06	88.4	36.72	29.0	40.35
6	23.1	29.09	92.3	26.25	39.6	99.43	75.5	40.25	90.0	36.90	30.5	41.06
7	24.0	29.27	93.9	26.42	41.1	500.11	76.4	40.44	91.6	37.08	32.0	41.76
8	24.8	29.45	95.6	26.60	42.6	00.79	77.2	40.63	93.3	37.26	33.5	42.47
9	25.7	29.64	97.2	26.77	44.2	01.47	78.1	40.82	94.9	37.44	35.0	43.18
10	1226.6	129.82	239.88	126.95	2345.7	502.16	1279.0	141.01	249.65	137.63	2436.6	543.89
11	27.5	30.00	240.5	27.12	47.2	02.84	79.9	41.20	96.1	37.81	36.1	44.60
12	28.3	30.19	02.1	27.29	48.7	03.52	80.7	41.39	98.8	37.99	37.6	45.31
13	29.2	30.37	03.7	27.47	50.2	04.20	81.6	41.58	250.4	38.17	41.1	46.02
14	30.1	30.55	05.3	27.64	51.8	04.89	82.5	41.78	03.0	38.35	42.6	46.73
15	30.9	30.74	07.0	27.82	53.3	05.57	83.4	41.97	04.6	38.53	44.1	47.44
16	31.8	30.92	08.6	27.99	54.8	06.26	84.2	42.16	06.3	38.72	45.6	48.15
17	32.7	31.10	10.2	28.17	56.3	06.94	85.1	42.35	07.9	38.90	47.1	48.86
18	33.6	31.29	11.9	28.34	57.8	07.63	86.0	42.54	09.5	39.08	48.6	49.57
19	34.4	31.47	13.5	28.52	59.4	08.31	86.9	42.73	11.2	39.26	50.1	50.29
20	1235.3	131.65	241.51	128.70	2360.9	509.00	1287.7	142.92	252.28	139.45	2451.6	551.00
21	36.2	31.84	16.7	28.87	62.4	09.69	87.6	43.12	14.4	39.63	53.1	51.71
22	37.0	32.02	18.4	29.05	63.9	10.37	88.5	43.31	16.0	39.81	54.6	52.43
23	37.9	32.20	20.0	29.22	65.4	11.06	89.4	43.50	17.7	40.00	56.1	53.14
24	38.8	32.39	21.6	29.40	66.9	11.75	91.2	43.69	19.3	40.18	57.6	53.85
25	39.7	32.57	23.3	29.58	68.5	12.44	92.1	43.89	20.9	40.36	59.2	54.57
26	40.5	32.76	24.9	29.75	70.0	13.13	93.0	44.08	22.5	40.55	60.7	55.29
27	41.4	32.94	26.5	29.93	71.5	13.82	93.9	44.27	24.2	40.73	62.2	56.00
28	42.3	33.13	28.1	30.10	73.0	14.51	94.7	44.47	25.8	40.91	63.7	56.72
29	43.2	33.31	29.8	30.28	74.5	15.20	95.6	44.66	27.4	41.10	65.2	57.43
30	1244.0	133.50	243.4	130.46	2376.0	515.89	1296.5	144.85	252.90	141.28	2466.7	558.15
31	44.9	33.68	31.0	30.64	76.6	16.58	97.4	45.05	30.7	41.46	68.2	58.87
32	45.8	33.87	34.7	30.81	79.1	17.27	98.2	45.24	32.3	41.65	69.7	59.59
33	46.6	34.05	36.3	30.99	80.6	17.97	99.1	45.43	33.9	41.83	71.2	60.31
34	47.5	34.24	37.9	31.17	82.1	18.66	100.0	45.63	35.5	42.02	72.7	61.03
35	48.4	34.42	39.6	31.34	83.6	19.35	00.9	45.82	37.2	42.20	74.2	61.75
36	49.3	34.61	41.2	31.52	85.1	20.05	01.7	46.01	38.8	42.39	75.7	62.47
37	50.1	34.80	42.8	31.70	86.7	20.74	02.6	46.21	40.4	42.57	77.2	63.19
38	51.0	34.98	44.4	31.88	88.2	21.43	03.5	46.40	42.0	42.76	78.7	63.91
39	51.9	35.17	46.1	32.05	89.7	22.13	04.4	46.60	43.7	42.94	80.2	64.63
40	1252.8	135.36	244.77	132.23	2391.2	522.82	1305.3	146.79	254.53	143.13	2481.7	565.35
41	53.6	35.54	49.3	32.41	92.7	23.52	06.1	46.99	46.9	43.31	83.2	66.07
42	54.5	35.73	50.9	32.59	94.2	24.22	07.0	47.18	48.5	43.50	84.7	66.79
43	55.4	35.92	52.6	32.77	95.7	24.91	07.9	47.38	50.2	43.68	86.2	67.52
44	56.3	36.10	54.2	32.94	97.3	25.61	08.8	47.57	51.8	43.87	87.7	68.24
45	57.1	36.29	55.8	33.12	98.8	26.31	09.6	47.77	53.4	44.05	89.2	68.96
46	58.0	36.48	57.5	33.30	2400.3	27.01	10.5	47.96	55.0	44.24	90.7	69.69
47	58.9	36.66	59.1	33.48	01.8	27.70	11.4	48.16	56.7	44.42	92.2	70.41
48	59.7	36.85	60.7	33.66	03.3	28.40	12.3	48.35	58.3	44.61	93.7	71.14
49	60.6	37.04	62.3	33.84	04.8	29.10	13.1	48.55	59.9	44.80	95.2	71.86
50	1261.5	137.23	246.00	134.02	2406.3	529.80	1314.0	148.75	256.15	144.98	2496.7	572.59
51	62.4	37.42	65.6	34.20	07.9	30.50	14.9	48.94	63.2	45.17	98.2	73.32
52	63.2	37.60	67.2	34.38	09.4	31.20	15.8	49.14	64.8	45.35	99.7	74.04
53	64.1	37.79	68.9	34.56	10.9	31.90	16.7	49.33	66.4	45.54	2501.2	74.77
54	65.0	37.98	70.5	34.74	12.4	32.60	17.5	49.53	68.0	45.73	02.7	75.50
55	65.9	38.17	72.1	34.92	13.9	33.31	18.4	49.73	69.7	45.91	04.2	76.23
56	66.7	38.36	73.7	35.10	15.4	34.01	19.3	49.92	71.3	46.10	05.7	76.96
57	67.6	38.55	75.4	35.28	16.9	34.71	20.2	50.12	72.9	46.29	07.2	77.69
58	68.5	38.74	77.0	35.46	18.4	35.42	21.0	50.32	74.5	46.48	08.7	78.41
59	69.4	38.92	78.6	35.64	19.9	36.12	21.9	50.52	76.2	46.66	10.2	79.14

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

23

26°						27°						I
T	E	C	M	X	Y	T	E	C	M	X	Y	
1322.8	50.71	25.778	146.85	2511.7	579.87	1375.6	162.81	26.751	158.31	2601.2	624.50	0
23.7	50.91	79.4	4.704	13.2	80.61	76.4	63.02	76.7	58.51	02.7	25.25	1
24.5	51.11	81.0	4.723	14.7	81.34	77.3	63.22	78.4	58.70	04.2	26.01	2
25.4	51.31	82.7	4.741	16.2	82.07	78.2	63.43	80.0	58.90	05.7	26.77	3
26.3	51.50	84.3	4.760	17.7	82.80	79.1	63.63	81.6	59.09	07.1	27.52	4
27.2	51.70	85.9	4.779	19.2	83.53	80.0	63.84	83.2	59.29	08.6	28.28	5
28.1	51.90	87.5	4.798	20.7	84.27	80.9	64.04	84.8	59.48	10.1	29.04	6
28.9	52.10	89.1	4.817	22.2	85.00	81.7	64.25	86.5	59.68	11.6	29.80	7
29.8	52.30	90.8	4.835	23.7	85.73	82.6	64.46	88.1	59.87	13.1	30.56	8
30.7	52.50	92.4	4.854	25.2	86.47	83.5	64.67	89.7	60.07	14.6	31.32	9
1331.6	52.69	2594.0	148.73	2526.7	587.20	1384.4	164.87	2691.3	160.26	2616.0	632.08	10
32.5	52.89	95.6	4.882	26.7	87.94	84.3	65.08	92.9	60.46	17.5	32.94	11
33.3	53.09	97.3	4.911	29.7	88.67	86.1	65.29	94.6	60.65	19.0	33.61	12
34.2	53.29	98.9	4.930	31.2	89.41	87.0	65.50	96.2	60.85	20.5	34.37	13
35.1	53.49	2600.5	49.49	32.7	90.15	87.9	65.70	97.8	61.05	22.0	35.13	14
36.0	53.69	02.1	49.68	34.2	90.88	88.8	65.91	99.4	61.24	23.5	35.89	15
36.8	53.89	02.8	49.86	35.7	91.62	89.7	66.12	2701.0	61.44	24.9	36.66	16
37.7	54.09	05.4	50.05	37.1	92.36	90.6	66.33	02.7	61.63	26.4	37.42	17
38.6	54.29	07.0	50.24	38.6	93.10	91.4	66.54	04.3	61.83	27.9	38.18	18
39.5	54.49	08.6	50.43	40.1	93.84	92.3	66.74	05.9	62.03	29.4	38.95	19
1340.4	54.69	2610.3	150.62	2541.6	594.57	1393.2	166.95	2707.5	162.23	2630.5	639.71	20
41.2	54.89	11.9	50.81	43.1	94.51	94.1	67.16	09.1	62.42	32.3	40.48	21
42.1	55.09	13.5	51.00	44.6	95.05	95.0	67.37	10.8	62.62	33.8	41.25	22
43.0	55.29	15.1	51.19	46.1	95.79	95.9	67.58	12.4	62.82	35.3	42.01	23
43.9	55.49	16.7	51.38	47.6	96.53	96.7	67.79	14.0	63.01	36.8	42.78	24
44.8	55.69	18.4	51.57	49.1	97.28	97.6	68.00	15.6	63.21	38.3	43.55	25
45.6	55.89	20.0	51.76	50.6	98.02	98.5	68.21	17.2	63.41	39.7	44.31	26
46.5	56.09	21.6	51.96	52.1	98.76	99.4	68.42	18.9	63.61	41.2	45.08	27
47.4	56.30	23.2	52.15	53.6	99.50	100.3	68.62	20.5	63.80	42.7	45.85	28
48.3	56.50	24.9	52.34	55.1	01.25	01.2	68.83	22.1	64.00	44.2	46.62	29
1349.2	56.70	2626.5	152.53	2556.6	601.99	1402.0	169.04	2723.7	164.20	2645.7	647.39	30
50.0	56.90	28.1	52.72	58.0	02.73	02.9	69.25	25.3	64.40	47.1	48.16	31
50.9	57.10	29.7	52.91	59.5	03.48	03.8	69.46	27.0	64.60	48.6	48.93	32
51.8	57.30	31.3	53.10	61.0	04.22	04.7	69.67	28.6	64.79	50.1	49.70	33
52.7	57.51	33.0	53.29	62.5	04.97	05.6	69.89	30.2	64.99	51.6	50.47	34
53.6	57.71	34.6	53.48	64.0	05.71	06.5	70.10	31.8	65.19	53.0	51.24	35
54.4	57.91	36.2	53.68	65.5	06.46	07.3	70.31	33.4	65.39	54.5	52.01	36
55.3	58.11	37.8	53.87	67.0	07.21	08.2	70.52	35.0	65.59	56.0	52.79	37
56.2	58.32	39.5	54.06	68.5	07.95	09.1	70.73	36.7	65.79	57.5	53.56	38
57.1	58.52	41.1	54.25	70.0	08.70	10.0	70.94	38.3	65.99	59.0	54.33	39
1358.0	58.72	2642.7	154.44	2571.5	609.45	1410.9	171.15	2739.9	166.19	2660.4	655.11	40
58.8	58.93	44.3	54.64	71.0	09.20	11.8	71.36	41.5	66.39	61.9	55.88	41
59.7	59.13	45.9	54.83	72.4	10.94	12.6	71.57	43.1	66.59	63.4	56.65	42
60.6	59.33	47.6	55.02	73.9	11.69	13.5	71.79	44.8	66.78	64.9	57.43	43
61.5	59.53	49.2	55.21	75.4	12.44	14.4	72.00	46.4	66.98	66.4	58.20	44
62.4	59.73	50.8	55.41	76.9	13.19	15.3	72.21	48.0	67.18	67.8	58.98	45
63.2	59.93	52.4	55.60	78.4	13.94	16.2	72.42	49.6	67.38	69.3	59.76	46
64.1	60.15	54.0	55.79	81.9	14.69	17.1	72.63	51.2	67.58	70.8	60.53	47
65.0	60.35	55.7	55.98	83.4	15.45	17.9	72.85	52.8	67.78	72.2	61.31	48
65.9	60.55	57.3	56.18	84.9	16.20	18.8	73.06	54.5	67.98	73.7	62.09	49
1366.8	60.76	2658.9	156.37	2586.3	616.95	1419.7	173.27	2756.1	168.18	2675.2	662.87	50
67.6	60.96	60.5	56.36	87.8	17.70	20.6	73.28	57.7	68.39	76.7	63.64	51
68.5	61.17	62.2	56.56	89.3	18.45	21.5	73.49	59.3	68.59	78.1	64.42	52
69.4	61.37	63.8	56.75	90.8	19.21	22.4	73.71	60.9	68.79	79.6	65.20	53
70.3	61.58	65.4	57.15	92.3	19.96	23.3	73.92	62.6	68.99	81.1	65.98	54
71.2	61.78	67.0	57.34	93.8	20.72	24.1	74.14	64.2	69.19	82.5	66.76	55
72.0	61.99	68.6	57.53	95.3	21.47	25.0	74.35	65.8	69.39	84.0	67.55	56
72.9	62.19	70.3	57.73	96.8	22.23	25.9	74.56	67.4	69.59	85.5	68.32	57
73.8	62.40	71.9	57.92	98.2	22.98	26.8	74.78	69.0	69.79	87.0	69.10	58
74.7	62.60	73.5	58.12	99.7	23.74	27.7	75.19	70.6	70.00	88.4	69.89	59



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

°	28°						29°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	1428.6	175.41	2772.3	170.20	2689.9	670.67	1481.8	188.51	2869.2	182.50	2777.8	718.38
1	29.4	75.62	73.9	70.40	91.4	71.45	82.7	88.73	70.8	82.71	79.2	19.19
2	30.3	75.83	75.5	70.60	92.9	72.23	83.6	89.95	72.4	82.92	80.7	20.06
3	31.2	76.05	77.1	70.80	94.3	73.02	84.5	91.18	74.0	83.13	82.2	20.81
4	32.1	76.26	78.7	71.00	95.8	73.80	85.3	92.40	75.6	83.34	83.6	21.62
5	33.0	76.48	80.3	71.21	97.3	74.59	86.2	93.62	77.2	83.55	85.1	22.43
6	33.9	76.69	82.0	71.41	98.7	75.37	87.1	94.85	78.9	83.76	86.5	23.29
7	34.8	76.91	83.6	71.61	2700.2	76.16	88.0	96.07	80.5	83.97	88.0	24.05
8	35.6	77.12	85.2	71.81	01.7	76.94	88.9	97.29	82.1	84.18	89.4	24.86
9	36.5	77.34	86.8	72.01	03.1	77.73	89.8	98.52	83.7	84.39	90.9	25.67
10	1437.4	177.55	2788.4	172.22	2704.6	678.52	1490.7	190.74	2885.3	184.60	2792.4	726.49
11	38.3	77.77	90.0	72.42	06.1	79.30	91.6	90.96	86.9	84.81	93.8	27.30
12	39.2	77.99	91.7	72.62	07.6	80.09	92.5	91.19	88.5	85.02	95.3	28.11
13	40.1	78.20	93.3	72.83	09.0	80.88	93.4	91.41	90.2	85.23	96.7	28.93
14	41.0	78.42	94.9	73.03	10.5	81.67	94.2	91.64	91.8	85.44	98.2	29.74
15	41.8	78.63	96.5	73.23	12.0	82.46	95.1	91.86	93.4	85.65	99.6	30.58
16	42.7	78.85	98.1	73.44	13.4	83.24	96.0	92.09	95.0	85.86	2801.1	31.37
17	43.6	79.07	99.7	73.64	14.9	84.03	96.9	92.31	96.6	86.07	02.5	32.08
18	44.5	79.28	2801.4	73.84	16.4	84.82	97.8	92.54	98.2	86.28	04.0	32.80
19	45.4	79.50	03.0	74.05	17.8	85.61	98.7	92.76	99.8	86.49	05.4	33.51
20	1446.3	179.72	2804.6	174.25	2719.3	686.40	1499.6	192.99	2901.4	186.70	2806.9	734.63
21	47.2	79.94	06.2	74.46	20.8	87.20	1500.5	93.21	03.1	86.91	08.3	35.45
22	48.1	80.15	07.8	74.66	22.2	87.99	01.4	93.44	04.7	87.12	09.8	36.26
23	48.9	80.37	09.4	74.86	23.7	88.78	02.3	93.67	06.3	87.33	11.3	37.08
24	49.8	80.59	11.1	75.07	25.2	89.57	03.1	93.89	07.9	87.54	12.7	37.90
25	50.7	80.80	12.7	75.27	26.6	90.36	04.0	94.12	09.5	87.76	14.2	38.72
26	51.6	81.02	14.3	75.48	28.1	91.15	04.9	94.34	11.1	87.97	15.6	39.54
27	52.5	81.24	15.9	75.68	29.6	91.95	05.8	94.57	12.7	88.18	17.1	40.36
28	53.4	81.46	17.5	75.89	31.0	92.73	06.7	94.80	14.3	88.39	18.5	41.18
29	54.3	81.67	19.1	76.09	32.5	93.54	07.6	95.02	15.9	88.60	20.0	42.00
30	1455.1	181.89	2820.7	176.30	2734.0	694.33	1508.5	195.25	2917.6	188.92	2821.4	742.82
31	56.0	82.11	22.4	76.50	35.4	95.13	09.4	95.49	19.2	89.03	22.9	43.64
32	56.9	82.33	24.0	76.71	36.9	95.93	10.3	95.70	20.8	89.24	24.3	44.46
33	57.8	82.55	25.6	76.91	38.3	96.72	11.2	95.93	22.4	89.45	25.8	45.28
34	58.7	82.77	27.2	77.12	39.8	97.52	12.1	96.16	24.0	89.67	27.2	46.10
35	59.6	82.99	28.8	77.32	41.3	98.32	12.9	96.39	25.6	89.88	28.7	46.93
36	60.5	83.21	30.4	77.53	42.7	99.11	13.8	96.61	27.2	90.09	30.1	47.75
37	61.4	83.42	32.1	77.73	44.2	99.91	14.7	96.84	28.8	90.30	31.6	48.57
38	62.2	83.64	33.7	77.94	45.7	200.71	15.6	97.07	30.5	90.52	33.0	49.40
39	63.1	83.86	35.3	78.15	47.1	01.51	16.5	97.30	32.1	90.73	34.5	50.22
40	1464.0	184.08	2836.9	178.35	2748.6	702.31	1517.4	197.53	2933.7	190.94	2835.9	751.05
41	64.9	84.30	38.5	78.56	50.1	03.11	18.3	97.75	33.3	91.16	37.4	51.87
42	65.8	84.52	40.1	78.77	51.5	03.91	19.2	97.98	36.9	91.37	38.8	52.70
43	66.7	84.74	41.7	78.97	53.0	04.71	20.1	98.21	38.5	91.58	40.3	53.52
44	67.6	84.96	43.4	79.18	54.4	05.51	21.0	98.44	40.1	91.80	41.7	54.35
45	68.5	85.18	45.0	79.39	55.9	06.31	21.9	98.67	41.7	92.01	43.1	55.17
46	69.3	85.40	46.6	79.59	57.4	07.11	22.8	98.90	43.3	92.23	44.6	56.00
47	70.2	85.63	48.2	79.80	58.8	07.92	23.6	99.13	45.0	92.44	46.0	56.83
48	71.1	85.85	49.8	80.01	60.3	08.72	24.5	99.36	46.6	92.65	47.5	57.66
49	72.0	86.07	51.4	80.21	61.7	09.52	25.4	99.59	48.2	92.87	48.9	58.49
50	1472.9	186.29	2853.0	180.42	2763.2	710.33	1526.3	199.82	2949.8	193.08	2850.4	759.32
51	73.8	86.51	54.7	80.63	64.7	11.13	27.2	200.05	51.4	93.30	51.8	60.14
52	74.7	86.73	56.3	80.84	66.1	11.93	28.1	00.28	53.0	93.51	53.3	60.97
53	75.6	86.95	57.9	81.05	67.6	12.74	29.0	00.51	54.6	93.73	54.7	61.80
54	76.5	87.17	59.5	81.25	69.0	13.54	29.9	00.74	56.2	93.94	56.2	62.64
55	77.3	87.40	61.1	81.46	70.5	14.35	30.8	00.97	57.8	94.16	57.6	63.47
56	78.2	87.62	62.7	81.67	72.0	15.15	31.7	01.20	59.4	94.37	59.0	64.30
57	79.1	87.84	64.3	81.88	73.4	15.96	32.6	01.43	61.1	94.59	60.5	65.13
58	80.0	88.06	66.0	82.09	74.9	16.77	33.5	01.66	62.7	94.80	61.9	65.96
59	80.9	88.28	67.6	82.29	76.3	17.58	34.4	01.89	64.3	95.02	63.4	66.79



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

25

30°							31°							
T	E	C	M	X	Y		T	E	C	M	X	Y	°	
1535.3	202.12	2965.9	195.23	2864.8	762.63	1589.0	216.25	3062.4	208.36	2951.0	678.38	0	1	
36.1	02.35	67.5	95.45	66.3	68.46	89.9	16.49	64.0	08.61	52.4	19.24	1	2	
37.0	02.58	69.1	95.66	67.7	69.30	90.8	16.73	65.6	08.83	53.8	20.10	2	3	
37.9	02.81	70.7	95.88	69.2	70.13	91.7	16.97	67.2	09.05	55.3	20.96	3	4	
38.8	03.05	72.3	96.10	70.6	70.96	92.6	17.21	68.8	09.28	56.7	21.82	4	5	
39.7	03.28	72.9	96.31	72.0	71.80	93.5	17.45	70.4	09.50	58.1	22.68	5	6	
40.6	03.51	75.5	96.53	73.5	72.63	94.4	17.69	72.0	09.72	59.6	23.54	6	7	
41.5	03.74	77.2	96.75	74.9	73.47	95.3	17.93	73.6	09.95	61.0	24.40	7	8	
42.4	03.97	78.8	96.96	76.4	74.31	96.2	18.17	75.2	10.17	62.4	25.26	8	9	
43.3	04.21	80.4	97.18	77.8	75.15	97.1	18.41	76.8	10.39	63.8	26.12	9	10	
1544.2	204.44	2982.0	197.40	2879.2	775.98	1598.0	218.66	3078.4	210.62	2965.3	682.99	10	11	
45.1	04.67	83.6	97.61	80.7	76.82	98.8	18.90	80.0	10.84	66.7	27.85	11	12	
46.0	04.90	85.2	97.83	82.1	77.66	99.7	19.14	81.6	11.07	68.1	28.71	12	13	
46.9	05.14	86.8	98.05	83.6	78.50	100.6	19.38	83.2	11.29	69.5	29.58	13	14	
47.8	05.37	88.4	98.26	85.0	79.33	01.5	19.62	84.8	11.51	71.0	30.44	14	15	
48.7	05.60	90.0	98.48	86.4	80.17	02.4	19.86	86.4	11.74	72.4	31.30	15	16	
49.6	05.84	91.6	98.70	87.9	81.01	03.3	20.11	88.1	11.96	73.8	32.17	16	17	
50.4	06.07	93.2	98.92	89.3	81.85	04.2	20.35	89.7	12.19	75.2	33.03	17	18	
51.3	06.30	94.9	99.13	90.8	82.70	05.1	20.59	91.3	12.41	76.7	33.90	18	19	
52.2	06.54	96.5	99.35	92.2	83.54	06.0	20.83	92.9	12.64	78.1	34.77	19	20	
1553.1	206.77	2998.1	199.57	2893.6	789.38	1606.9	221.08	3094.5	212.86	2979.5	685.63	20	21	
54.0	07.01	99.7	99.79	95.1	85.22	07.8	21.32	96.1	13.09	80.9	36.50	21	22	
54.9	07.24	100.3	100.01	96.5	86.06	08.7	21.56	97.7	13.31	82.4	37.37	22	23	
55.8	07.48	02.9	00.22	98.0	86.90	09.6	21.80	99.3	13.54	83.8	38.23	23	24	
56.7	07.71	04.5	00.44	99.4	87.75	10.5	22.05	100.9	13.76	85.2	39.10	24	25	
57.6	07.94	06.1	00.66	100.8	88.59	11.4	22.29	02.5	13.99	86.6	39.97	25	26	
58.5	08.18	07.7	00.88	02.3	89.44	12.3	22.53	04.1	14.21	88.0	40.84	26	27	
59.4	08.41	09.3	01.10	03.7	90.28	13.2	22.78	05.7	14.44	89.5	41.71	27	28	
60.3	08.65	10.9	01.32	05.1	91.12	14.1	23.02	07.3	14.67	90.9	42.58	28	29	
61.2	08.88	12.5	01.54	06.6	91.97	15.0	23.27	08.9	14.89	92.3	43.45	29	30	
1562.1	209.12	3014.2	201.76	2908.0	792.82	1615.9	223.51	3110.5	215.12	2993.7	684.32	30	31	
63.0	09.36	15.8	01.98	09.5	93.66	16.8	24.75	12.1	15.34	95.2	45.19	31	32	
63.9	09.59	17.4	02.19	10.9	94.51	17.7	24.00	13.7	15.57	96.6	46.06	32	33	
64.8	09.83	19.0	02.41	12.3	95.36	18.6	24.24	15.3	15.80	98.0	46.93	33	34	
65.7	10.06	20.6	02.63	13.8	96.20	19.5	24.49	16.9	16.02	99.4	47.81	34	35	
66.6	10.30	22.2	02.85	15.2	97.05	20.4	24.73	18.5	16.25	100.8	48.68	35	36	
67.5	10.53	23.8	03.07	16.6	97.90	21.3	24.98	20.1	16.48	02.3	49.55	36	37	
68.4	10.77	25.4	03.29	18.1	98.75	22.2	25.22	21.7	16.70	03.7	50.43	37	38	
69.2	11.01	27.0	03.51	19.5	99.60	23.1	25.47	23.3	16.93	05.1	51.30	38	39	
70.1	11.25	28.6	03.73	20.9	100.45	24.0	25.71	25.0	17.16	06.5	52.17	39	40	
1571.0	211.48	3030.2	203.95	2922.4	801.30	1624.9	225.96	3126.6	217.39	3007.9	685.05	40	41	
71.9	11.72	31.8	04.17	23.8	02.15	25.8	26.21	28.2	17.61	09.4	53.92	41	42	
72.8	11.96	33.4	04.39	25.2	03.00	26.7	26.45	29.8	17.84	10.8	54.80	42	43	
73.7	12.19	35.1	04.62	26.7	03.85	27.6	26.70	31.4	18.07	12.2	55.68	43	44	
74.6	12.43	36.7	04.84	28.1	04.70	28.5	26.94	33.0	18.30	13.6	56.55	44	45	
75.5	12.67	38.3	05.06	29.5	05.55	29.4	27.19	34.6	18.52	15.0	57.43	45	46	
76.4	12.91	39.9	05.28	31.0	06.40	30.3	27.44	36.2	18.75	16.4	58.31	46	47	
77.3	13.14	41.5	05.50	32.4	07.26	31.2	27.68	37.8	18.98	17.9	59.18	47	48	
78.2	13.38	43.1	05.72	33.8	08.11	32.1	27.93	39.4	19.21	19.3	60.06	48	49	
79.1	13.62	44.7	05.94	35.3	08.94	33.0	28.18	41.0	19.44	20.7	60.94	49	50	
1580.0	213.86	3046.3	206.16	2936.7	809.82	1633.9	228.42	3142.6	219.67	3022.1	686.82	50	51	
80.9	14.10	47.9	06.19	38.1	10.67	34.8	28.67	44.2	19.89	23.5	62.70	51	52	
81.8	14.34	49.5	06.41	39.6	11.53	35.7	28.92	45.8	20.12	24.9	63.58	52	53	
82.7	14.57	51.1	06.63	41.0	12.38	36.6	29.17	47.4	20.35	26.4	64.46	53	54	
83.6	14.81	52.7	07.05	42.4	13.24	37.5	29.41	49.0	20.58	27.8	65.34	54	55	
84.5	15.05	54.3	07.27	43.8	14.09	38.4	29.66	50.6	20.81	29.2	66.22	55	56	
85.4	15.29	55.9	07.49	45.3	14.95	39.3	29.91	52.2	21.04	30.6	67.10	56	57	
86.3	15.53	57.5	07.72	46.7	15.81	40.2	30.16	53.8	21.27	32.0	67.98	57	58	
87.2	15.77	59.2	07.94	48.1	16.67	41.1	30.40	55.4	21.50	33.4	68.87	58	59	
88.1	16.01	60.8	08.16	49.6	17.52	42.0	30.65	57.0	21.73	34.8	69.75	59	60	

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	36°						37°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	1861.7	294.86	354.11	280.43	336.78	1094.3	1917.1	312.22	363.61	296.09	344.82	1153.7
1	62.6	95.44	42.7	80.69	69.2	95.2	18.0	12.52	37.7	96.35	49.5	54.8
2	63.5	95.43	44.3	80.94	70.5	96.2	19.0	12.81	39.3	96.62	50.9	55.8
3	64.4	95.72	45.9	81.20	71.8	97.2	19.9	13.10	40.8	96.88	52.2	56.8
4	65.4	96.00	47.5	81.46	73.2	98.2	20.8	13.40	42.4	97.15	53.5	57.8
5	66.3	96.29	49.0	81.72	74.5	99.2	21.7	13.69	44.0	97.41	54.8	58.8
6	67.8	96.57	50.6	81.98	75.9	100.2	22.7	13.99	45.6	97.68	56.2	59.8
7	68.1	96.86	52.2	82.23	77.2	01.1	23.6	14.28	47.2	97.94	57.5	60.8
8	69.0	97.14	53.8	82.49	78.6	02.1	24.5	14.58	48.7	98.21	58.8	61.8
9	70.0	97.43	55.4	82.75	79.9	03.1	25.5	14.87	50.3	98.47	60.2	62.8
10	1870.9	297.72	355.70	283.01	338.13	1104.1	1926.4	315.17	365.79	298.74	346.5	1163.8
11	71.8	98.00	57.0	83.27	82.6	05.1	27.3	15.47	53.5	99.00	62.8	64.8
12	72.7	98.29	60.1	83.53	84.0	06.1	28.2	15.76	55.1	99.27	64.1	65.8
13	73.7	98.57	61.7	83.79	85.3	07.0	29.2	16.06	56.6	99.53	65.5	66.8
14	74.6	98.86	63.3	84.05	86.7	08.0	30.1	16.35	58.2	99.80	66.8	67.8
15	75.5	99.15	64.9	84.31	88.0	09.0	31.0	16.65	59.8	100.07	68.1	68.8
16	76.4	99.44	66.5	84.57	89.3	10.0	32.0	16.95	61.4	00.33	69.4	69.8
17	77.4	99.73	68.1	84.83	90.7	11.0	32.9	17.24	62.9	00.60	70.8	70.9
18	78.3	100.01	69.6	85.08	92.0	12.0	33.8	17.54	64.5	00.87	72.1	71.9
19	79.2	00.30	71.2	85.34	93.4	13.0	34.7	17.84	66.1	01.13	73.4	72.9
20	1880.1	300.59	357.28	285.60	339.47	1113.9	1935.7	318.13	366.77	301.40	347.4	1173.9
21	81.0	00.87	74.4	85.86	96.1	14.9	36.6	18.43	69.3	01.67	76.1	74.9
22	82.0	01.16	76.0	86.12	97.4	15.9	37.5	18.73	70.8	01.93	77.4	75.9
23	82.9	01.45	77.6	86.38	98.7	16.9	38.5	19.03	72.4	02.20	78.7	76.9
24	83.8	01.74	79.1	86.64	100.1	17.9	39.4	19.32	74.0	02.47	80.1	77.9
25	84.7	02.03	80.7	86.90	01.4	18.9	40.3	19.62	75.6	02.73	81.4	78.9
26	85.7	02.32	82.3	87.16	02.8	19.9	41.2	19.92	77.2	03.00	82.7	80.0
27	86.6	02.60	83.9	87.42	04.1	20.9	42.2	20.22	78.7	03.27	84.0	81.0
28	87.5	02.89	85.5	87.68	05.4	21.9	43.1	20.52	80.3	03.54	85.3	82.0
29	88.4	03.18	87.1	87.95	06.8	22.8	44.0	20.81	81.9	03.80	86.7	83.0
30	1889.4	303.47	358.86	288.21	340.81	1123.8	1945.0	321.11	368.35	304.07	348.80	1184.0
31	90.3	03.76	90.2	88.47	09.5	24.8	45.9	21.41	85.0	04.34	89.3	85.0
32	91.2	04.05	91.8	88.73	10.8	25.8	46.8	21.71	86.6	04.61	90.6	86.0
33	92.1	04.34	93.4	88.99	12.1	26.8	47.7	22.01	88.2	04.88	92.0	87.1
34	93.1	04.63	95.0	89.25	13.5	27.8	48.7	22.31	89.8	05.14	93.3	88.1
35	94.0	04.92	96.6	89.51	14.8	28.8	49.6	22.61	91.4	05.41	94.6	89.1
36	94.9	05.21	98.1	89.77	16.2	29.8	50.5	22.91	92.9	05.68	95.9	90.1
37	95.8	05.50	99.7	90.04	17.5	30.8	51.5	23.21	94.5	05.95	97.2	91.1
38	96.7	05.79	101.3	90.30	18.8	31.8	52.4	23.51	96.1	06.22	98.6	92.1
39	97.7	06.08	102.9	90.56	20.2	32.8	53.3	23.81	97.7	06.49	99.9	93.2
40	1898.6	306.37	360.45	290.82	342.15	1133.8	1954.3	324.11	369.93	306.76	350.12	1194.2
41	99.5	06.66	106.0	91.08	22.8	34.8	55.2	24.41	100.8	07.03	102.5	95.2
42	100.4	06.95	107.6	91.35	24.2	35.8	56.1	24.71	102.4	07.29	103.8	96.2
43	101.4	07.25	109.2	91.61	25.5	36.8	57.0	25.01	104.0	07.56	105.2	97.2
44	102.3	07.54	110.8	91.87	26.9	37.7	58.0	25.31	105.6	07.83	106.5	98.3
45	103.2	07.83	112.4	92.13	28.2	38.7	58.9	25.61	107.1	08.10	107.8	99.3
46	104.1	08.12	113.9	92.40	29.5	39.7	59.8	25.91	108.7	08.37	109.1	100.3
47	105.1	08.41	115.5	92.66	30.9	40.7	60.8	26.21	110.3	08.64	110.4	101.3
48	106.0	08.70	117.1	92.92	32.2	41.7	61.7	26.51	111.9	08.91	111.7	102.3
49	106.9	09.00	118.7	93.19	33.5	42.7	62.6	26.81	113.4	09.18	113.1	103.4
50	1907.9	309.29	362.03	293.45	343.49	1143.7	1963.6	327.12	372.50	309.45	351.44	1204.4
51	108.8	09.58	119.9	93.71	34.2	44.7	64.5	27.42	116.6	09.72	115.7	105.4
52	109.7	09.87	121.4	93.98	35.5	45.7	65.4	27.72	118.2	09.99	117.0	106.4
53	110.6	10.17	123.0	94.24	36.9	46.7	66.4	28.03	119.7	10.26	118.3	107.4
54	111.6	10.46	124.6	94.50	38.2	47.7	67.3	28.33	121.3	10.53	119.6	108.5
55	112.5	10.75	126.2	94.77	39.5	48.7	68.2	28.63	122.9	10.80	120.9	109.5
56	113.4	11.05	127.8	95.03	40.9	49.7	69.1	28.93	124.5	11.07	122.3	110.5
57	114.3	11.34	129.3	95.29	42.2	50.7	70.1	29.24	126.1	11.35	123.6	111.5
58	115.3	11.63	130.9	95.56	43.5	51.7	71.0	29.54	127.6	11.62	124.9	112.6
59	116.2	11.92	132.5	95.82	44.9	52.7	71.9	29.84	129.2	11.89	126.2	113.6

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

38°						39°						I
T	E	C	M	X	Y	T	E	C	M	X	Y	
1972.9	530.15	3720.8	312.16	3527.5	1214.6	2029.0	348.64	3825.2	3286.4	3605.8	1276.9	0
73.8	30.45	32.4	12.43	20.8	15.7	29.9	48.95	26.8	28.92	07.1	77.9	1
74.7	30.75	33.9	12.70	30.2	16.7	30.9	49.27	28.3	29.20	08.4	79.0	2
75.7	31.06	35.5	12.97	31.5	17.7	31.8	49.58	29.9	29.48	09.7	80.0	3
76.6	31.36	37.1	13.25	32.8	18.7	32.7	49.89	31.5	29.76	11.0	81.1	4
77.5	31.67	38.7	13.52	34.1	19.8	33.7	50.21	33.0	30.04	12.3	82.1	5
78.5	31.97	40.2	13.79	35.4	20.8	34.6	50.52	34.6	30.32	13.6	83.2	6
79.4	32.27	41.8	14.06	36.7	21.8	35.5	50.84	36.2	30.59	14.8	84.2	7
80.3	32.58	43.4	14.33	38.0	22.8	36.5	51.15	37.8	30.87	16.1	85.3	8
81.3	32.88	45.0	14.61	39.3	23.9	37.4	51.47	39.3	31.15	17.4	86.3	9
1982.2	333.19	3744.5	314.88	3540.6	1224.9	2038.4	351.78	3840.9	331.43	3618.7	1287.4	10
83.1	33.49	48.1	15.15	42.0	25.9	39.3	52.10	42.5	31.71	20.0	88.4	11
84.1	33.80	49.7	15.42	43.3	27.0	40.2	52.41	44.0	31.99	21.3	89.5	12
85.0	34.11	51.3	15.70	44.6	28.0	41.2	52.72	45.6	32.27	22.6	90.5	13
85.9	34.41	52.8	15.97	45.9	29.0	42.1	53.04	47.2	32.55	23.9	91.6	14
86.9	34.72	54.4	16.24	47.2	30.1	43.1	53.36	48.7	32.83	25.2	92.7	15
87.8	35.02	56.0	16.51	48.5	31.1	44.0	53.67	50.3	33.11	26.5	93.7	16
88.7	35.33	57.6	16.79	49.8	32.1	44.9	53.99	51.9	33.39	27.8	94.8	17
89.7	35.63	59.1	17.06	51.1	33.2	45.9	54.30	53.5	33.67	29.1	95.8	18
90.6	35.94	60.7	17.34	52.4	34.2	46.8	54.62	55.0	33.95	30.3	96.9	19
1991.5	336.25	3762.3	317.61	3553.7	1235.2	2047.8	354.94	3856.6	334.23	3631.6	1297.9	20
92.5	36.55	63.9	17.88	55.0	36.3	48.7	55.25	58.2	34.51	32.9	99.0	21
93.4	36.86	65.4	18.16	56.3	37.3	49.6	55.57	59.7	34.79	34.2	100.0	22
94.3	37.17	67.0	18.43	57.7	38.3	50.6	55.89	61.3	35.07	35.5	01.1	23
95.3	37.48	68.6	18.70	59.0	39.4	51.5	56.20	62.9	35.35	36.8	02.2	24
96.2	37.78	70.2	18.98	60.3	40.4	52.5	56.52	64.4	35.63	38.1	03.2	25
97.1	38.09	71.7	19.25	61.6	41.4	53.4	56.84	66.0	35.92	39.4	04.3	26
98.1	38.40	73.3	19.53	62.9	42.5	54.3	57.15	67.6	36.20	40.6	05.3	27
99.0	38.71	74.9	19.80	64.2	43.5	55.3	57.47	69.2	36.48	41.9	06.4	28
99.9	39.01	76.5	20.08	65.5	44.5	56.2	57.79	70.7	36.76	43.2	07.4	29
2000.9	339.32	3778.0	320.35	3566.8	1245.6	2057.2	358.11	3872.3	337.04	3644.5	1308.5	30
01.8	39.63	78.0	20.63	66.8	45.6	57.1	58.12	72.3	37.02	44.5	08.6	31
02.8	39.94	81.2	20.90	69.4	47.7	59.0	58.74	75.4	37.60	47.1	10.6	32
03.7	40.25	82.7	21.18	70.7	48.7	60.0	59.06	77.0	37.89	48.4	11.7	33
04.6	40.56	84.3	21.45	72.0	49.7	60.9	59.38	78.6	38.17	49.6	12.8	34
05.6	40.87	85.9	21.73	73.3	50.8	61.9	59.70	80.1	38.45	50.9	13.8	35
06.5	41.17	87.5	22.00	74.6	51.8	62.8	60.02	81.7	38.73	52.2	14.9	36
07.4	41.48	89.0	22.28	75.9	52.9	63.7	60.34	83.3	39.01	53.5	15.9	37
08.4	41.79	90.6	22.55	77.2	53.9	64.7	60.65	84.8	39.30	54.8	17.0	38
09.3	42.10	92.2	22.83	78.5	54.9	65.6	60.97	86.4	39.58	56.1	18.1	39
2010.2	342.41	3793.8	323.10	3579.8	1256.0	2066.6	361.29	3888.0	339.86	3657.4	1319.1	40
11.2	42.72	95.3	23.18	81.1	57.0	67.5	61.61	89.5	40.15	58.6	20.2	41
12.1	43.03	96.9	23.66	82.4	58.1	68.5	61.93	91.1	40.43	59.9	21.3	42
13.0	43.34	98.5	23.93	83.7	59.1	69.4	62.25	92.7	40.71	61.2	22.3	43
14.0	43.65	100.0	24.21	85.0	60.1	70.3	62.57	94.2	40.99	62.5	23.4	44
14.9	43.96	01.6	24.48	86.3	61.2	71.3	62.89	95.8	41.28	63.8	24.5	45
15.9	44.27	03.2	24.76	87.6	62.2	72.2	63.21	97.4	41.56	65.0	25.5	46
16.8	44.59	04.8	25.04	88.9	63.3	73.2	63.53	98.9	41.84	66.3	26.6	47
17.7	44.90	06.3	25.31	90.2	64.3	74.1	63.85	100.5	42.13	67.6	27.7	48
18.7	45.21	07.9	25.59	91.5	65.4	75.0	64.18	02.1	42.41	68.9	28.7	49
2019.6	345.52	3809.5	325.87	3592.8	1266.4	2076.0	364.50	3903.6	342.70	3670.2	1329.8	50
20.5	45.83	11.0	26.15	94.1	67.5	76.9	64.82	03.2	42.98	71.4	30.9	51
21.5	46.14	12.6	26.42	95.4	68.5	77.9	65.14	04.8	43.26	72.7	31.9	52
22.4	46.45	14.2	26.70	96.7	69.5	78.8	65.46	06.3	43.55	74.0	33.0	53
23.4	46.77	15.8	26.98	98.0	70.6	79.8	65.78	07.9	43.83	75.3	34.1	54
24.3	47.08	17.3	27.25	99.3	71.6	80.7	66.10	09.5	44.12	76.6	35.1	55
25.2	47.39	18.9	27.53	100.6	72.7	81.6	66.43	11.0	44.40	77.8	36.2	56
26.2	47.70	20.5	27.81	01.9	73.7	82.6	66.75	12.6	44.69	79.1	37.3	57
27.1	48.02	22.1	28.09	03.2	74.8	83.5	67.07	14.2	44.97	80.4	38.3	58
28.0	48.33	23.6	28.37	04.5	75.8	84.5	67.39	15.7	45.26	81.7	39.4	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	40°						41°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	2085.4	36722	3919.3	345.54	36829	1340.5	2142.2	3927.8	4013.1	362.85	3759.0	1405.4
1	86.4	68.04	20.9	45.83	84.2	41.6	43.2	87.71	14.7	63.14	60.2	06.5
2	87.3	68.04	22.4	46.11	85.5	42.6	44.1	88.04	16.2	63.43	61.5	07.6
3	88.3	68.69	24.0	46.40	86.8	43.7	45.1	88.36	17.8	63.72	62.8	08.7
4	89.2	69.01	25.6	46.68	88.1	44.8	46.0	88.71	19.4	64.01	64.0	09.8
5	90.1	69.33	27.1	46.97	89.3	45.8	47.0	89.04	20.9	64.31	65.3	10.9
6	91.1	69.66	28.7	47.25	90.6	46.9	47.9	89.38	22.5	64.60	66.5	12.0
7	92.0	69.98	30.3	47.54	91.9	48.0	48.9	89.71	24.1	64.89	67.8	13.1
8	93.0	70.30	31.8	47.82	93.2	49.1	49.8	90.04	25.6	65.18	69.0	14.2
9	93.9	70.63	33.4	48.11	94.4	50.1	50.8	90.38	27.2	65.48	70.3	15.3
10	2094.9	370.95	3935.0	348.40	3695.7	1351.2	2151.7	390.71	4028.7	365.77	3771.5	1416.4
11	95.8	71.26	36.5	48.68	97.0	52.3	52.7	91.05	30.3	66.06	72.8	17.5
12	96.8	71.60	38.1	48.97	98.2	53.4	53.6	91.38	31.9	66.36	74.1	18.6
13	97.7	71.93	39.7	49.26	99.5	54.4	54.6	91.72	33.4	66.65	75.3	19.7
14	98.6	72.25	41.2	49.54	3700.8	55.5	55.5	92.05	35.0	66.94	76.6	20.8
15	99.4	72.58	42.8	49.83	02.1	56.6	56.5	92.39	36.5	67.24	77.8	21.9
16	2100.5	72.90	44.4	50.12	03.3	57.7	57.4	92.72	38.1	67.53	79.1	23.0
17	01.5	73.23	45.9	50.40	04.6	58.7	58.4	93.06	39.7	67.82	80.3	24.1
18	02.4	73.55	47.5	50.69	05.9	59.8	59.3	93.39	41.2	68.12	81.6	25.2
19	03.4	73.88	49.1	50.98	07.2	60.9	60.3	93.73	42.8	68.41	82.8	26.3
20	2104.3	374.20	3950.6	351.26	3708.4	1362.0	2161.2	394.06	4044.3	368.71	3784.1	1427.4
21	05.3	74.53	52.2	51.55	09.7	63.1	62.2	94.40	43.9	69.00	85.3	28.5
22	06.2	74.86	53.7	51.84	11.0	64.1	63.1	94.74	45.5	69.29	86.6	29.6
23	07.2	75.18	55.3	52.13	12.2	65.2	64.1	95.07	47.0	69.59	87.8	30.7
24	08.1	75.51	56.9	52.41	13.5	66.3	65.1	95.41	50.6	69.88	89.1	31.8
25	09.0	75.84	58.5	52.69	14.8	67.4	66.0	95.74	52.1	70.18	90.3	32.9
26	10.0	76.16	60.1	52.98	16.0	68.5	67.0	96.08	53.7	70.47	91.6	34.0
27	10.9	76.49	61.6	53.28	17.3	69.5	67.9	96.42	55.3	70.77	92.8	35.1
28	11.9	76.82	63.1	53.57	18.6	70.6	68.9	96.76	56.8	71.06	94.1	36.2
29	12.8	77.15	64.7	53.85	19.8	71.7	69.8	97.09	58.4	71.36	95.3	37.3
30	2113.8	377.47	3966.3	354.14	3721.1	1372.8	2170.8	397.43	4059.9	371.65	3796.6	1438.4
31	14.7	77.80	67.8	54.43	22.4	73.9	71.7	97.77	61.5	71.95	97.8	39.5
32	15.7	78.13	69.4	54.72	23.6	75.0	72.7	98.11	63.0	72.24	99.1	40.6
33	16.6	78.46	71.0	55.01	24.9	76.0	73.6	98.45	64.6	72.54	3800.3	41.7
34	17.6	78.79	72.5	55.30	26.2	77.1	74.6	98.78	66.2	72.83	01.6	42.8
35	18.5	79.11	74.1	55.59	27.4	78.2	75.5	99.12	67.7	73.13	02.8	43.9
36	19.5	79.44	75.6	55.87	28.7	79.3	76.5	99.46	69.3	73.43	04.1	45.0
37	20.4	79.77	77.2	56.16	30.0	80.4	77.4	99.80	70.8	73.72	05.3	46.1
38	21.4	80.10	78.8	56.45	31.2	81.5	78.4	100.14	72.4	74.02	06.6	47.2
39	22.3	80.43	80.3	56.74	32.5	82.5	79.4	100.48	74.0	74.31	07.8	48.4
40	2123.3	380.76	3981.9	357.03	3733.8	1383.6	2180.3	400.82	4075.5	374.61	3809.0	1449.5
41	24.2	81.09	83.5	57.32	35.0	84.7	81.3	101.16	77.1	74.91	10.3	50.6
42	25.1	81.42	85.0	57.61	36.3	85.8	82.2	101.49	78.6	75.20	11.5	51.7
43	26.1	81.75	86.6	57.90	37.6	86.9	83.2	101.83	80.2	75.50	12.8	52.8
44	27.0	82.08	88.1	58.19	38.8	88.0	84.1	102.17	81.7	75.80	14.0	53.9
45	28.0	82.41	89.7	58.48	40.1	89.1	85.1	102.52	83.3	76.09	15.3	55.0
46	28.9	82.74	91.3	58.77	41.3	90.2	86.0	102.86	84.9	76.39	16.5	56.1
47	29.9	83.07	92.8	59.06	42.6	91.2	87.0	103.20	86.4	76.69	17.8	57.2
48	30.8	83.40	94.4	59.35	43.9	92.3	87.9	103.54	88.0	76.98	19.0	58.3
49	31.8	83.73	96.0	59.64	45.1	93.4	88.9	103.88	89.5	77.28	20.2	59.4
50	2132.7	384.06	3997.5	359.93	3746.4	1394.5	2189.9	401.22	4091.1	377.58	3821.5	1460.6
51	33.7	84.39	99.1	60.22	47.7	95.6	90.8	104.56	92.6	77.88	23.7	61.7
52	34.6	84.72	100.6	60.51	48.9	96.7	91.8	104.90	94.2	78.18	24.9	62.8
53	35.6	85.05	102.2	60.80	50.2	97.8	92.7	105.24	95.8	78.47	25.2	63.9
54	36.5	85.39	103.8	61.10	51.4	98.9	93.7	105.58	97.3	78.77	26.4	65.0
55	37.5	85.72	105.3	61.39	52.7	100.0	94.6	105.92	98.9	79.07	27.7	66.1
56	38.4	86.05	106.9	61.68	54.0	101.1	95.6	106.27	100.4	79.37	28.9	67.2
57	39.4	86.38	108.4	61.97	55.2	102.1	96.5	106.61	102.0	79.67	30.2	68.3
58	40.3	86.71	110.0	62.26	56.5	103.2	97.5	106.95	103.5	79.96	31.4	69.4
59	41.3	87.05	111.6	62.55	57.7	104.3	98.5	107.29	105.1	80.26	32.6	70.6

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

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42°							43°						
T	E	C	M	X	Y		T	E	C	M	X	Y	I
2199.4	407.64	4106.6	380.56	3833.9	1471.7	2257.0	428.50	4199.8	398.68	3902.6	1539.2	0	
2200.4	07.98	08.2	80.86	35.1	72.8	5.79	28.85	4201.4	98.99	08.8	40.4	1	
01.3	08.32	09.8	81.16	36.4	73.9	5.89	29.21	02.9	99.29	10.0	41.5	2	
02.3	08.66	11.3	81.46	37.6	75.0	5.99	29.56	04.5	99.60	11.3	42.7	3	
03.2	09.01	12.9	81.76	38.8	76.2	6.08	29.91	06.0	99.91	12.5	43.8	4	
04.2	09.35	14.4	82.06	40.1	77.3	6.18	30.27	07.6	400.21	13.7	44.9	5	
05.1	09.69	16.0	82.35	41.3	78.5	6.27	30.62	09.2	06.52	14.9	46.1	6	
06.1	10.04	17.5	82.65	42.5	79.5	6.37	30.97	10.7	06.82	16.1	47.2	7	
07.1	10.38	19.1	82.95	43.8	80.6	6.47	31.32	12.3	01.13	17.4	48.4	8	
08.0	10.73	20.6	83.25	45.0	81.7	6.56	31.68	13.8	01.44	18.6	49.5	9	
2209.0	411.07	4122.2	383.55	3846.3	1482.9	2266.6	432.04	4215.4	401.74	3919.8	1550.6	10	
09.9	11.42	23.8	83.95	47.5	84.0	6.76	32.39	16.9	02.05	21.0	51.8	11	
10.9	11.76	25.3	84.15	48.7	85.1	6.85	32.74	18.4	02.36	22.2	52.9	12	
11.8	12.10	26.9	84.45	50.0	86.2	6.95	33.10	20.0	02.66	23.4	54.1	13	
12.8	12.45	28.4	84.75	51.2	87.3	7.05	33.46	21.5	02.97	24.6	55.2	14	
13.8	12.79	30.0	85.05	52.4	88.5	7.14	33.81	23.1	03.28	25.9	56.3	15	
14.7	13.14	31.5	85.35	53.7	89.6	7.24	34.17	24.6	03.58	27.1	57.5	16	
15.7	13.49	33.1	85.65	54.9	90.7	7.34	34.52	26.2	03.89	28.3	58.6	17	
16.6	13.83	34.6	85.95	56.1	91.8	7.43	34.88	27.7	04.20	29.5	59.8	18	
17.6	14.18	36.2	86.26	57.4	92.9	7.53	35.23	29.3	04.51	30.7	60.9	19	
2218.6	414.52	4137.7	386.56	3858.6	1494.1	2276.2	435.59	4230.8	404.81	3931.9	1562.1	20	
19.5	14.87	37.3	86.86	59.8	95.2	7.72	35.95	32.4	05.12	33.1	63.2	21	
20.5	15.21	40.9	87.16	61.1	96.3	7.82	36.30	33.9	05.43	34.3	64.3	22	
21.4	15.56	42.4	87.46	62.3	97.4	7.91	36.66	35.5	05.74	35.6	65.5	23	
22.4	15.91	44.0	87.76	63.5	98.6	8.01	37.02	37.0	06.05	36.8	66.6	24	
23.3	16.25	45.5	88.06	64.7	99.7	8.11	37.37	38.6	06.35	38.0	67.8	25	
24.3	16.60	47.1	88.36	66.0	100.8	8.20	37.73	40.1	06.66	39.2	68.9	26	
25.3	16.95	48.6	88.67	67.2	01.9	83.0	38.09	41.7	06.97	40.4	70.1	27	
26.2	17.30	50.2	88.97	68.4	03.1	84.0	38.44	43.2	07.28	41.6	71.2	28	
27.2	17.64	51.7	89.27	69.7	04.2	84.9	38.80	44.8	07.59	42.8	72.4	29	
2228.1	417.99	4153.3	389.57	3870.9	1505.3	2285.9	439.16	4244.3	407.90	3944.0	1573.5	30	
29.1	18.34	54.8	89.87	72.1	06.4	86.9	39.52	47.9	08.21	45.2	74.7	31	
30.1	18.69	56.4	90.18	73.4	07.6	87.8	39.88	49.4	08.51	46.4	75.8	32	
31.0	19.03	57.9	90.48	74.6	08.7	88.8	40.24	51.0	08.82	47.6	77.0	33	
32.0	19.38	59.5	90.78	75.8	09.8	89.8	40.59	52.5	09.13	48.9	78.1	34	
32.9	19.73	61.1	91.08	77.0	10.9	90.7	40.95	54.1	09.44	50.1	79.3	35	
33.9	20.08	62.6	91.38	78.3	12.1	91.7	41.31	55.6	09.75	51.3	80.4	36	
34.9	20.43	64.2	91.69	79.5	13.2	92.7	41.67	57.2	10.06	52.5	81.5	37	
35.9	20.78	65.7	91.99	80.7	14.3	93.6	42.03	58.7	10.37	53.7	82.7	38	
36.8	21.13	67.3	92.29	81.9	15.5	94.6	42.39	60.3	10.68	54.9	83.8	39	
2237.7	421.48	4168.8	392.60	3883.2	1516.6	2295.6	442.75	4261.8	410.99	3956.1	1585.0	40	
38.7	21.82	70.4	92.90	84.4	17.7	96.5	43.11	63.4	11.30	57.3	86.1	41	
39.7	22.17	71.9	93.20	85.6	18.8	97.5	43.47	64.9	11.61	58.5	87.2	42	
40.6	22.52	73.5	93.51	86.8	20.0	98.5	43.83	66.4	11.92	59.7	88.4	43	
41.6	22.88	75.0	93.81	88.1	21.1	99.4	44.19	68.0	12.23	60.9	89.6	44	
42.5	23.23	76.6	94.11	89.3	22.3	2300.4	44.55	69.5	12.54	62.1	90.8	45	
43.5	23.58	78.1	94.42	90.5	23.4	01.4	44.91	71.1	12.85	63.3	91.9	46	
44.5	23.93	79.7	94.72	91.7	24.5	02.3	45.27	72.6	13.16	64.5	93.1	47	
45.4	24.28	81.2	95.03	93.0	25.6	03.3	45.63	74.2	13.47	65.7	94.2	48	
46.4	24.63	82.8	95.33	94.2	26.8	04.3	45.99	75.7	13.78	66.9	95.4	49	
2247.3	424.98	4184.3	395.63	3895.4	1527.9	2305.2	446.35	4277.3	414.10	3968.1	1596.5	50	
48.3	25.33	85.9	95.94	96.6	29.0	06.2	46.72	78.8	14.41	69.3	97.7	51	
49.3	25.68	87.4	96.24	97.9	30.2	07.2	47.08	80.4	14.72	70.5	98.8	52	
50.2	26.03	89.0	96.55	99.1	31.3	08.1	47.44	81.9	15.03	71.7	100.0	53	
51.2	26.39	90.5	96.85	100.3	32.4	09.1	47.80	83.5	15.34	72.9	01.1	54	
52.2	26.74	92.1	97.16	01.5	33.6	10.1	48.16	85.0	15.65	74.1	02.3	55	
53.1	27.09	93.6	97.46	02.7	34.7	11.1	48.53	86.5	15.96	75.3	03.5	56	
54.1	27.44	95.2	97.77	04.0	35.8	12.0	48.89	88.1	16.28	76.5	04.6	57	
55.0	27.79	96.7	98.07	05.2	37.0	13.0	49.25	89.6	16.59	77.7	05.8	58	
56.0	28.15	98.3	98.38	06.4	38.1	14.0	49.61	91.2	16.90	78.9	06.9	59	

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	44°						45°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	2314.9	449.98	4292.7	417.21	3980.1	1608.1	2373.3	472.08	4385.3	416.14	4051.5	1678.2
1	15.9	50.34	94.3	17.52	81.3	09.2	74.3	72.45	86.8	36.46	52.7	79.4
2	16.9	50.70	95.8	17.83	82.5	10.4	75.3	72.83	88.4	36.78	53.8	80.5
3	17.8	51.07	97.4	18.15	83.7	11.6	76.2	73.20	89.9	37.10	55.0	81.7
4	18.8	51.45	98.9	18.46	84.9	12.7	77.2	73.57	91.4	37.42	56.2	82.9
5	19.8	51.79	4300.5	18.77	86.1	13.9	78.2	73.95	93.0	37.74	57.4	84.1
6	20.7	52.16	02.0	19.09	87.3	15.0	79.2	74.32	94.5	38.06	58.5	85.3
7	21.7	52.52	03.5	19.40	88.5	16.2	80.1	74.70	96.1	38.38	59.7	86.4
8	22.7	52.89	05.1	19.71	89.7	17.4	81.1	75.07	97.6	38.70	60.9	87.6
9	23.7	53.25	06.6	20.03	90.9	18.5	82.1	75.45	99.1	39.02	62.1	88.8
10	2324.6	453.62	4308.2	420.34	3992.1	1619.7	2383.1	475.82	4400.7	439.34	4063.2	1690.0
11	25.6	53.98	09.7	20.65	93.3	20.8	84.0	76.20	02.2	39.66	64.4	91.2
12	26.6	54.35	11.3	20.97	94.5	22.0	85.0	76.57	03.8	39.98	65.6	92.3
13	27.5	54.71	12.8	21.28	95.7	23.2	86.0	76.95	05.3	40.30	66.8	93.5
14	28.5	55.08	14.4	21.59	96.9	24.3	87.0	77.33	06.8	40.62	67.9	94.7
15	29.5	55.44	15.9	21.91	98.1	25.5	88.0	77.70	08.4	40.94	69.1	95.9
16	30.5	55.81	17.4	22.22	99.3	26.7	88.9	78.08	09.9	41.26	70.3	97.1
17	31.4	56.18	19.0	22.53	4000.5	27.8	89.9	78.46	11.4	41.58	71.5	98.3
18	32.4	56.54	20.5	22.85	01.7	29.0	90.9	78.83	13.0	41.90	72.6	99.4
19	33.4	56.91	22.1	23.16	02.9	30.1	91.9	79.21	14.5	42.22	73.8	1700.6
20	2334.3	457.77	4323.6	423.48	4004.1	1631.3	2392.8	479.59	4416.1	442.54	4075.0	1701.8
21	35.3	57.64	23.2	23.79	05.3	32.5	93.8	79.96	17.6	42.87	76.1	03.0
22	36.3	58.01	24.7	24.11	06.4	33.6	94.8	80.34	19.1	43.19	77.3	04.2
23	37.3	58.37	26.2	24.42	07.6	34.8	95.8	80.72	20.7	43.51	78.5	05.4
24	38.2	58.74	28.8	24.74	08.8	36.0	96.8	81.10	22.2	43.83	79.7	06.6
25	39.2	59.11	31.3	25.05	10.0	37.1	97.7	81.47	23.8	44.15	80.8	07.7
26	40.2	59.48	32.9	25.37	11.2	38.3	98.7	81.85	25.3	44.47	82.0	08.9
27	41.1	59.84	34.4	25.68	12.4	39.5	99.7	82.23	26.8	44.79	83.2	10.1
28	42.1	60.21	36.0	26.00	13.6	40.6	4000.7	82.61	28.4	45.12	84.3	11.3
29	43.1	60.58	37.5	26.31	14.8	41.8	01.7	82.99	29.9	45.44	85.5	12.5
30	2344.1	460.95	4339.0	426.63	4016.0	1643.0	2402.6	483.37	4431.4	445.76	4086.7	1713.7
31	45.0	61.32	40.6	26.94	17.2	44.1	03.6	83.75	33.0	46.08	87.8	14.9
32	46.0	61.69	42.1	27.26	18.3	45.3	04.6	84.12	34.5	46.41	89.0	16.1
33	47.0	62.05	43.7	27.57	19.5	46.5	05.6	84.50	36.0	46.73	90.2	17.3
34	48.0	62.42	45.2	27.89	20.7	47.7	06.6	84.88	37.6	47.05	91.3	18.4
35	48.9	62.79	46.8	28.21	21.9	48.8	07.5	85.26	39.1	47.37	92.5	19.6
36	49.9	63.16	48.3	28.52	23.1	50.0	08.5	85.64	40.7	47.70	93.7	20.8
37	50.9	63.53	49.8	28.84	24.3	51.2	09.5	86.02	42.2	48.02	94.8	22.0
38	51.8	63.90	51.4	29.15	25.5	52.3	10.5	86.40	43.7	48.34	96.0	23.2
39	52.8	64.27	52.9	29.47	26.7	53.5	11.5	86.78	45.3	48.67	97.2	24.4
40	2353.8	464.64	4354.5	429.79	4027.8	1654.7	2412.4	487.17	4446.8	448.99	4098.3	1725.6
41	54.8	65.01	56.0	30.11	29.0	55.8	13.4	87.55	48.3	49.31	99.5	26.8
42	55.7	65.38	57.6	30.42	30.2	57.0	14.4	87.93	49.9	49.64	4100.7	28.0
43	56.7	65.75	59.1	30.74	31.4	58.2	15.4	88.31	51.4	49.96	01.8	29.2
44	57.7	66.12	60.6	31.06	32.6	59.4	16.4	88.69	52.9	50.28	03.0	30.4
45	58.7	66.49	62.2	31.37	33.8	60.5	17.4	89.07	54.5	50.61	04.2	31.6
46	59.6	66.86	63.7	31.69	34.9	61.7	18.3	89.45	56.0	50.93	05.3	32.8
47	60.6	67.24	65.3	32.01	36.1	62.9	19.3	89.83	57.6	51.26	06.5	34.0
48	61.6	67.61	66.8	32.32	37.3	64.1	20.3	90.21	59.1	51.58	07.6	35.1
49	62.6	67.98	68.3	32.64	38.5	65.2	21.3	90.60	60.6	51.90	08.8	36.3
50	2363.5	468.35	4369.9	432.96	4039.7	1666.4	2422.3	490.98	4462.2	452.23	4110.0	1737.5
51	64.5	68.72	71.4	33.28	40.9	67.6	23.2	91.36	63.7	52.55	11.1	38.7
52	65.5	69.10	73.0	33.60	42.0	68.8	24.2	91.75	65.2	52.88	12.3	39.9
53	66.5	69.47	74.5	33.91	43.2	69.9	25.2	92.13	66.8	53.20	13.5	41.1
54	67.4	69.84	76.0	34.23	44.4	71.1	26.2	92.51	68.3	53.53	14.6	42.3
55	68.4	70.21	77.6	34.55	45.6	72.3	27.2	92.90	69.8	53.85	15.8	43.5
56	69.4	70.58	79.1	34.87	46.8	73.5	28.2	93.28	71.4	54.18	16.9	44.7
57	70.4	70.96	80.7	35.19	47.9	74.6	29.1	93.66	72.9	54.50	18.1	45.9
58	71.3	71.33	82.2	35.51	49.1	75.8	30.1	94.05	74.4	54.83	19.2	47.1
59	72.3	71.70	83.7	35.82	50.3	77.0	31.1	94.43	76.0	55.15	20.4	48.3

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

46°						47°						P
T	E	C	M	X	Y	T	E	C	M	X	Y	
2432.1	494.82	44775	455.48	4121.6	17495	2491.3	518.20	4569.4	475.22	4190.4	1822.0	0
33.1	95.20	79.0	55.80	22.7	50.7	92.3	18.59	70.9	75.55	91.5	23.3	1
34.1	95.58	80.6	56.13	23.9	51.9	93.3	18.99	72.4	76.88	92.7	24.5	2
35.0	95.97	82.1	56.46	25.0	53.1	94.3	19.38	74.0	77.21	93.8	25.7	3
36.0	96.35	83.6	56.78	26.2	54.3	95.3	19.78	75.5	77.55	94.9	26.9	4
37.0	96.74	85.2	57.11	27.3	55.5	96.3	20.17	77.0	77.88	96.1	28.1	5
38.0	97.12	86.7	57.43	28.5	56.7	97.3	20.57	78.6	78.21	97.2	29.4	6
39.0	97.51	88.2	57.76	29.7	57.9	98.3	20.97	80.1	78.55	98.3	30.6	7
40.0	97.89	89.8	58.09	30.8	59.1	99.3	21.36	81.6	78.88	99.3	31.8	8
40.9	98.28	91.3	58.41	32.0	60.3	2500.2	21.76	83.1	79.21	4200.6	33.0	9
2441.9	498.67	4492.8	458.74	4133.1	17615	2501.2	522.16	4584.7	478.55	4201.7	1834.2	10
42.9	99.05	94.4	59.07	34.3	62.7	02.2	22.55	84.2	79.55	02.9	35.5	11
43.9	99.44	95.9	59.39	35.4	63.9	03.2	22.95	85.7	79.91	04.0	36.7	12
44.9	99.83	97.4	59.72	36.6	65.1	04.2	23.35	87.2	80.27	05.1	37.9	13
45.9	500.21	99.0	60.05	37.7	66.3	05.2	23.75	90.8	80.63	06.3	39.1	14
46.9	00.60	4500.5	60.38	38.9	67.5	06.2	24.14	92.3	80.99	07.4	40.4	15
47.8	00.99	02.0	60.70	40.0	68.7	07.2	24.54	93.8	81.35	08.5	41.6	16
48.8	01.37	03.6	61.03	41.2	69.9	08.2	24.94	95.4	81.71	09.7	42.8	17
49.8	01.76	05.1	61.36	42.3	71.1	09.2	25.34	96.9	82.07	10.8	44.0	18
50.8	02.15	06.6	61.69	43.5	72.3	10.2	25.74	98.4	82.43	11.9	45.3	19
2451.8	502.54	4508.2	462.01	4144.6	17735	2511.2	526.17	4599.9	481.98	4213.1	18465	20
52.8	02.92	09.7	62.34	45.8	74.8	12.2	26.53	4601.5	82.79	46.2	47.7	21
53.8	03.31	11.2	62.67	46.9	76.0	13.2	26.93	03.0	83.15	47.3	48.9	22
54.7	03.70	12.8	63.00	48.1	77.2	14.1	27.33	04.5	83.50	48.5	50.2	23
55.7	04.09	14.3	63.33	49.2	78.4	15.1	27.73	06.0	83.86	49.7	51.4	24
56.7	04.48	15.8	63.65	50.4	79.6	16.1	28.13	07.6	84.21	50.9	52.6	25
57.7	04.87	17.4	63.98	51.5	80.8	17.1	28.53	09.1	84.59	52.1	53.8	26
58.7	05.26	18.9	64.31	52.7	82.0	18.1	28.93	10.6	84.95	53.3	55.1	27
59.7	05.65	20.4	64.64	53.8	83.2	19.1	29.33	12.1	85.32	54.5	56.3	28
60.7	06.03	22.0	64.97	55.0	84.4	20.1	29.73	13.7	85.69	55.7	57.5	29
2461.7	506.42	45235	465.30	4156.1	17856	2521.1	530.13	4615.2	485.24	4224.3	18588	30
62.6	06.81	23.0	65.63	57.3	86.8	22.1	30.53	16.7	86.07	56.9	60.0	31
63.6	07.20	24.6	65.96	58.4	88.0	23.1	30.93	18.2	86.43	57.9	61.2	32
64.6	07.59	26.1	66.29	59.6	89.2	24.1	31.33	19.8	86.79	58.9	62.4	33
65.6	07.98	27.6	66.62	60.7	90.5	25.1	31.72	21.3	87.15	59.9	63.7	34
66.6	08.37	29.1	66.94	61.9	91.7	26.1	32.12	22.8	87.51	60.9	64.9	35
67.6	08.76	30.7	67.27	63.0	92.9	27.1	32.52	24.3	87.87	61.9	66.1	36
68.6	09.16	32.2	67.60	64.2	94.1	28.1	32.92	25.9	88.23	62.9	67.3	37
69.6	09.55	33.7	67.93	65.3	95.3	29.1	33.32	27.4	88.59	63.9	68.5	38
70.5	09.94	35.3	68.26	66.5	96.5	30.1	33.72	28.9	88.95	64.9	69.7	39
2471.5	510.33	45388	468.59	4167.6	17977	2531.1	534.15	4630.4	488.60	4235.6	1871.1	40
72.5	10.72	40.3	68.92	68.7	98.9	32.1	34.55	32.0	89.33	65.9	72.3	41
73.5	11.11	41.9	69.25	69.9	100.2	33.1	34.95	33.5	89.69	66.9	73.5	42
74.5	11.51	43.4	69.58	71.0	01.4	34.1	35.36	35.0	89.96	67.9	74.8	43
75.5	11.90	44.9	69.91	72.2	02.6	35.0	35.76	36.5	90.32	68.9	76.0	44
76.5	12.29	46.4	70.24	73.3	03.8	36.0	36.16	38.1	90.68	69.9	77.2	45
77.5	12.68	48.0	70.58	74.5	05.0	37.0	36.56	39.6	91.04	70.9	78.5	46
78.5	13.07	49.5	70.91	75.6	06.2	38.0	36.97	41.1	91.40	71.9	79.7	47
79.4	13.47	51.0	71.24	76.7	07.4	39.0	37.37	42.6	91.76	72.9	80.9	48
80.4	13.86	52.6	71.57	77.9	08.6	40.0	37.78	44.2	92.12	73.9	82.2	49
2481.4	514.25	4554.1	471.90	4179.0	1809.9	2541.0	538.18	4645.7	491.97	4246.8	1883.4	50
82.4	14.65	55.6	72.23	80.2	11.1	42.0	38.58	47.2	92.31	74.9	84.5	51
83.4	15.04	57.2	72.56	81.3	12.3	43.0	38.99	48.7	92.65	75.9	85.7	52
84.4	15.43	58.7	72.89	82.4	13.5	44.0	39.39	50.3	92.99	76.9	87.0	53
85.4	15.83	60.2	73.23	83.6	14.7	45.0	39.80	51.8	93.32	77.9	88.3	54
86.4	16.22	61.7	73.56	84.7	15.9	46.0	40.20	53.3	93.66	78.9	89.6	55
87.4	16.62	63.3	73.89	85.9	17.2	47.0	40.61	54.8	94.00	79.9	90.8	56
88.4	17.01	64.8	74.22	87.0	18.4	48.0	41.02	56.3	94.34	80.9	92.1	57
89.3	17.41	66.3	74.55	88.1	19.6	49.0	41.42	57.9	94.68	81.9	93.3	58
90.3	17.80	67.9	74.88	89.3	20.8	50.0	41.83	59.4	95.02	82.9	94.5	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	48°						49°					
	T	E	C	M	X	Y	T	E	C	M	X	Y
0	255.1	542.23	4660.9	495.35	42580	1895.8	261.2	566.94	4752.1	515.89	4324.2	1970.7
1	52.0	42.64	62.4	95.89	59.1	97.0	12.2	67.35	53.6	16.24	25.3	71.9
2	53.0	43.05	64.0	96.03	60.2	98.2	13.2	67.77	55.1	16.58	26.4	72.9
3	54.0	43.45	65.5	96.37	61.3	99.5	14.2	68.19	56.6	16.93	27.5	74.0
4	55.0	43.86	67.0	96.71	62.4	100.7	15.2	68.61	58.1	17.27	28.6	75.1
5	56.0	44.27	68.5	97.05	63.5	102.0	16.2	69.03	59.7	17.62	29.7	76.2
6	57.0	44.67	70.1	97.39	64.6	103.2	17.2	69.44	61.2	17.97	30.8	77.2
7	58.0	45.08	71.6	97.73	65.8	104.4	18.2	69.86	62.7	18.31	31.9	78.5
8	59.0	45.49	73.1	98.07	66.9	105.7	19.2	70.28	64.2	18.66	33.0	80.7
9	60.0	45.90	74.6	98.41	68.0	106.9	20.2	70.70	65.7	19.01	34.0	82.0
10	256.1	546.30	4676.1	498.75	4269.1	1908.2	262.2	571.2	4767.3	519.35	4335.1	1983.3
11	62.0	46.71	77.7	99.09	70.2	109.4	22.2	71.54	68.8	19.70	36.2	84.5
12	63.0	47.12	79.2	99.43	71.3	110.7	23.2	71.96	70.3	20.05	37.3	85.8
13	64.0	47.53	80.7	99.77	72.4	111.9	24.2	72.38	71.8	20.39	38.4	87.0
14	65.0	47.94	82.2	100.11	73.5	113.1	25.2	72.80	73.3	20.74	39.5	88.3
15	66.0	48.35	83.7	100.45	74.6	114.4	26.2	73.22	74.8	21.09	40.6	89.6
16	67.0	48.75	85.3	100.79	75.8	115.6	27.2	73.64	76.3	21.43	41.7	90.8
17	68.0	49.16	86.8	101.13	76.9	116.9	28.2	74.06	77.8	21.78	42.8	92.1
18	69.0	49.57	88.3	101.47	78.0	118.1	29.2	74.48	79.4	22.13	43.9	93.4
19	70.0	49.98	89.8	101.81	79.1	119.4	30.2	74.90	80.9	22.48	44.9	94.6
20	257.1	550.39	4691.3	502.16	4280.2	1920.6	263.3	575.32	4782.4	522.82	4346.0	1995.9
21	72.0	50.80	92.9	102.50	81.3	121.8	32.3	75.74	83.9	23.17	47.1	97.1
22	73.0	51.21	94.4	102.84	82.4	123.1	33.3	76.16	85.4	23.52	48.2	98.4
23	74.0	51.62	95.9	103.18	83.5	124.3	34.3	76.59	87.0	23.87	49.3	99.7
24	75.0	52.03	97.4	103.52	84.6	125.6	35.3	77.01	88.5	24.22	50.4	100.9
25	76.0	52.44	99.0	103.86	85.7	126.8	36.4	77.43	90.0	24.56	51.4	102.2
26	77.0	52.85	100.5	104.20	86.8	128.1	37.4	77.85	91.5	24.91	52.5	103.5
27	78.0	53.27	102.0	104.53	87.9	129.3	38.4	78.27	93.0	25.26	53.6	104.7
28	79.0	53.68	103.5	104.89	89.0	130.6	39.4	78.70	94.5	25.61	54.7	106.0
29	80.0	54.09	105.0	105.23	90.1	131.8	40.4	79.12	96.0	25.96	55.8	107.3
30	258.1	554.50	4706.6	505.57	4291.2	1933.1	264.4	579.54	4797.5	526.31	4356.9	2008.5
31	82.0	54.91	108.1	105.91	92.4	134.3	42.4	79.97	99.1	26.66	57.9	109.8
32	83.0	55.32	109.6	106.26	93.5	135.6	43.4	80.39	100.6	27.01	59.0	111.1
33	84.0	55.74	111.1	106.60	94.6	136.8	44.4	80.81	102.1	27.35	60.1	112.3
34	85.0	56.15	112.6	106.94	95.7	138.1	45.4	81.24	103.6	27.70	61.2	113.6
35	86.0	56.56	114.1	107.29	96.8	139.3	46.5	81.66	105.1	28.05	62.3	114.9
36	87.0	56.97	115.7	107.63	97.9	140.6	47.5	82.08	106.6	28.40	63.3	116.2
37	88.0	57.39	117.2	107.97	99.0	141.8	48.5	82.51	108.1	28.75	64.4	117.4
38	89.0	57.80	118.7	108.31	100.1	143.1	49.5	82.93	109.7	29.10	65.5	118.7
39	90.0	58.21	120.2	108.66	101.2	144.3	50.5	83.36	111.2	29.45	66.6	120.0
40	259.1	558.63	4721.7	509.00	4302.3	1945.6	265.5	583.78	4812.7	529.80	4367.7	2021.2
41	92.0	59.04	123.3	109.34	103.4	146.8	52.5	84.21	112.7	30.15	67.7	122.5
42	93.0	59.45	124.8	109.69	104.5	148.1	53.5	84.63	114.2	30.50	68.8	123.8
43	94.0	59.87	126.3	110.03	105.6	149.3	54.6	85.06	115.7	30.85	70.9	125.0
44	95.0	60.28	127.8	110.37	106.7	150.6	55.6	85.48	117.2	31.20	72.0	126.3
45	96.0	60.70	129.3	110.72	107.8	151.8	56.6	85.91	118.7	31.55	73.1	127.6
46	97.0	61.11	130.9	111.06	108.9	153.1	57.6	86.33	120.2	31.90	74.1	128.9
47	98.0	61.52	132.4	111.41	110.0	154.3	58.6	86.76	121.7	32.25	75.2	130.1
48	99.1	61.94	133.9	111.75	111.1	155.6	59.6	87.19	123.2	32.60	76.3	131.4
49	260.1	62.36	135.4	112.10	112.2	156.8	60.6	87.61	124.7	32.96	77.4	132.7
50	261.1	562.77	4736.9	512.44	4313.3	1958.1	266.6	588.04	4827.8	533.31	4378.4	2033.9
51	02.1	63.19	138.4	112.78	114.4	159.4	62.7	88.47	126.3	33.66	79.5	135.2
52	03.1	63.60	140.0	113.13	115.5	160.6	63.7	88.90	127.8	34.01	80.6	136.5
53	04.1	64.02	141.5	113.47	116.6	161.9	64.7	89.32	129.3	34.36	81.7	137.8
54	05.1	64.44	143.0	113.82	117.7	163.1	65.7	89.75	130.8	34.71	82.7	139.0
55	06.1	64.85	144.5	114.16	118.8	164.4	66.7	90.18	132.3	35.06	83.8	140.3
56	07.1	65.27	146.0	114.51	119.8	165.6	67.7	90.61	133.8	35.42	84.9	141.6
57	08.1	65.69	147.5	114.85	120.9	166.9	68.7	91.03	135.3	35.77	86.0	142.9
58	09.1	66.10	149.1	115.20	122.0	168.1	69.8	91.46	136.8	36.12	87.0	144.1
59	10.1	66.52	150.6	115.54	123.1	169.4	70.8	91.89	138.3	36.47	88.1	145.4



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

35

50°				51°				52°				/
T	E	C	M	T	E	C	M	T	E	C	M	
267.8	592.32	4842.9	536.82	273.9	618.39	4933.4	558.15	279.5	645.17	5023.4	578.87	0
72.8	92.75	44.4	37.18	33.9	18.83	34.9	58.51	95.6	45.62	24.9	80.24	1
73.8	93.18	45.9	37.53	34.9	19.27	36.4	58.87	96.6	46.08	26.4	80.61	2
74.8	93.61	47.4	37.88	36.0	19.72	37.9	59.23	97.6	46.53	27.9	80.97	3
75.8	94.04	49.0	38.23	37.0	20.16	39.4	59.59	98.7	46.98	29.4	81.34	4
76.9	94.47	50.5	38.59	38.0	20.60	40.9	59.95	99.7	47.43	30.9	81.70	5
77.9	94.90	52.0	38.94	39.0	21.04	42.4	60.31	2800.7	47.89	32.4	82.07	6
78.9	95.33	53.5	39.29	40.1	21.48	43.9	60.67	01.8	48.34	33.9	82.43	7
79.9	95.76	55.0	39.64	41.1	21.92	45.4	61.03	02.8	48.79	35.4	82.80	8
80.9	96.19	56.5	40.00	42.1	22.36	46.9	61.39	03.8	49.25	36.9	83.17	9
2681.9	596.62	4858.0	540.35	2743.1	622.81	4948.4	561.75	2804.9	649.70	5038.4	583.53	10
82.9	97.05	58.5	40.70	44.2	23.25	49.9	62.11	05.9	50.16	39.9	83.50	11
84.0	97.48	61.0	41.06	45.2	23.69	51.4	62.47	06.9	50.61	41.4	83.87	12
85.0	97.91	62.5	41.41	46.2	24.13	52.9	62.83	08.0	51.07	42.9	84.23	13
86.0	98.34	64.0	41.76	47.2	24.58	54.4	63.19	09.0	51.52	44.4	84.60	14
87.0	98.77	65.6	42.12	48.3	25.02	55.9	63.55	10.0	51.98	45.9	84.97	15
88.0	99.20	67.1	42.47	49.3	25.46	57.4	63.91	11.1	52.43	47.4	85.33	16
89.0	99.64	68.6	42.83	50.3	25.91	58.9	64.27	12.1	52.89	48.9	85.70	17
90.1	600.07	70.1	43.18	51.3	26.35	60.4	64.63	13.1	53.34	50.4	86.07	18
91.1	00.50	71.6	43.53	52.4	26.80	61.9	64.99	14.2	53.80	51.9	86.44	19
2691.1	600.93	4873.1	543.89	2753.4	627.34	4963.4	565.35	2815.2	654.25	5053.4	587.20	20
92.1	01.37	76.6	44.24	54.4	27.68	64.9	65.71	16.2	54.71	54.9	87.57	21
94.1	01.80	76.1	44.60	55.4	28.13	66.4	66.07	17.3	55.17	56.4	87.94	22
95.2	02.23	77.6	44.95	56.5	28.57	67.9	66.43	18.3	55.62	57.9	88.30	23
96.2	02.67	79.1	45.31	57.5	29.02	69.4	66.79	19.3	56.08	59.3	88.67	24
97.2	03.10	80.6	45.66	58.5	29.46	70.9	67.16	20.4	56.54	60.8	89.04	25
98.2	03.53	82.1	46.02	59.5	29.91	72.4	67.52	21.4	56.99	62.3	89.41	26
99.2	03.97	83.7	46.37	60.6	30.35	73.9	67.88	22.4	57.45	63.8	89.78	27
2700.2	04.40	85.2	46.73	61.6	30.80	75.4	68.24	23.5	57.91	65.3	90.15	28
01.3	04.83	86.7	47.08	62.6	31.25	76.9	68.60	24.5	58.37	66.8	90.51	29
2702.3	605.27	4888.2	547.44	2763.7	631.69	4978.4	568.96	2825.6	658.83	5068.3	590.88	30
03.3	05.70	89.7	47.79	64.7	32.14	79.9	69.23	26.6	59.29	69.8	91.25	31
04.3	06.14	91.2	48.15	65.7	32.59	81.4	69.69	27.6	59.74	71.3	91.62	32
05.3	06.57	92.7	48.51	66.7	33.03	82.9	70.05	28.7	60.20	72.8	91.99	33
06.4	07.01	94.2	48.86	67.8	33.48	84.4	70.41	29.7	60.66	74.3	92.36	34
07.4	07.44	95.7	49.22	68.8	33.93	85.9	70.78	30.7	61.12	75.8	92.73	35
08.4	07.88	97.2	49.57	69.8	34.37	87.4	71.14	31.8	61.58	77.3	93.10	36
09.4	08.32	98.7	49.93	70.8	34.82	88.9	71.50	32.8	62.04	78.8	93.47	37
10.4	08.75	4900.2	50.29	71.9	35.27	90.4	71.86	33.8	62.50	80.3	93.84	38
11.5	09.19	01.7	50.64	72.9	35.72	91.9	72.23	34.9	62.96	81.8	94.20	39
2712.5	609.62	4903.2	551.00	2773.9	636.17	4993.4	572.59	2835.9	663.42	5083.3	594.57	40
13.5	10.06	04.8	51.36	75.0	36.61	94.9	72.95	37.0	63.88	84.8	94.94	41
14.5	10.50	06.3	51.71	76.0	37.06	96.4	73.32	38.0	64.34	86.2	95.31	42
15.5	10.93	07.8	52.07	77.0	37.51	97.9	73.68	39.0	64.80	87.7	95.68	43
16.6	11.37	09.3	52.43	78.1	37.96	99.4	74.04	40.1	65.26	89.2	96.05	44
17.6	11.81	10.8	52.78	79.1	38.41	5000.9	74.41	41.1	65.72	90.7	96.42	45
18.6	12.25	12.3	53.14	80.1	38.86	01.4	74.77	42.1	66.18	92.2	96.79	46
19.6	12.68	13.8	53.50	81.1	39.31	02.9	75.13	43.2	66.64	93.7	97.16	47
20.6	13.12	15.3	53.85	82.2	39.76	04.4	75.50	44.2	67.11	95.2	97.53	48
21.7	13.56	16.8	54.21	83.2	40.21	05.9	75.86	45.3	67.57	96.7	97.91	49
2722.7	614.00	4918.3	554.57	2784.2	640.66	5008.4	576.23	2846.3	668.03	5098.2	598.28	50
23.7	14.44	19.8	54.93	85.3	41.11	09.9	76.59	47.3	68.49	99.7	98.65	51
24.7	14.88	21.3	55.29	86.3	41.56	11.4	76.96	48.4	68.96	5101.2	99.02	52
25.7	15.31	22.8	55.64	87.3	42.01	12.9	77.32	49.4	69.42	02.7	99.39	53
26.8	15.75	24.3	56.00	88.4	42.46	14.4	77.68	50.5	69.88	04.2	99.76	54
27.8	16.19	25.8	56.36	89.4	42.91	15.9	78.05	51.5	70.34	05.7	100.13	55
28.8	16.63	27.3	56.72	90.4	43.36	17.4	78.41	52.5	70.81	07.1	100.50	56
29.8	17.07	28.8	57.08	91.4	43.81	18.9	78.78	53.6	71.27	08.6	100.87	57
30.9	17.51	30.3	57.43	92.5	44.27	20.4	79.14	54.6	71.74	10.1	101.25	58
31.9	17.95	31.8	57.79	93.5	44.72	21.9	79.51	55.7	72.20	11.6	101.62	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	53°				54°				55°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	2856.7	672.66	511.1	601.99	2919.4	700.89	5202.4	624.50	2982.7	729.85	5291.3	647.39
1	527	73.13	14.6	02.36	20.5	01.36	03.9	24.87	83.7	30.34	92.8	47.77
2	58.8	73.59	16.1	02.73	21.5	01.84	03.4	25.25	84.8	30.83	94.3	48.16
3	59.8	74.06	17.6	03.11	22.6	02.32	06.9	25.63	85.8	31.32	95.8	48.54
4	60.9	74.52	19.1	03.48	23.6	02.79	08.4	26.01	86.9	31.81	97.2	48.93
5	61.9	74.99	20.6	03.85	24.7	03.27	09.8	26.39	88.0	32.30	98.7	49.31
6	62.9	75.45	22.1	04.22	25.7	03.75	11.3	26.77	89.0	32.79	5300.2	49.70
7	64.0	75.92	23.6	04.60	26.8	04.23	12.8	27.14	90.1	33.28	01.7	50.08
8	65.0	76.39	25.0	04.97	27.8	04.71	14.3	27.52	91.1	33.77	03.1	50.47
9	66.1	76.85	26.5	05.34	28.9	05.18	15.8	27.90	92.2	34.26	04.6	50.86
10	2867.1	677.32	512.8	605.71	2929.9	705.66	5217.3	628.28	2993.3	734.76	5306.1	651.84
11	68.2	77.78	29.5	06.09	31.0	06.14	18.7	28.66	93.3	35.25	07.6	51.63
12	69.2	78.25	31.0	06.46	32.0	06.62	20.2	29.04	94.4	35.74	09.0	52.01
13	70.2	78.72	32.5	06.83	33.1	07.10	21.7	29.42	95.5	36.23	10.5	52.40
14	71.3	79.19	34.0	07.21	34.1	07.58	23.2	29.80	97.5	36.72	12.0	52.79
15	72.3	79.65	35.5	07.58	35.2	08.06	24.7	30.18	98.6	37.21	13.5	53.17
16	73.4	80.12	37.0	07.95	36.2	08.54	26.2	30.56	99.6	37.70	15.0	53.56
17	74.4	80.59	38.5	08.33	37.3	09.02	27.6	30.94	3000.7	38.20	16.4	53.94
18	75.5	81.05	39.9	08.70	38.3	09.50	29.1	31.32	01.8	38.69	17.9	54.33
19	76.5	81.52	41.4	09.07	39.4	09.98	30.6	31.70	02.8	39.18	19.4	54.72
20	2877.5	681.99	514.2	609.45	2940.4	710.46	5232.1	632.08	3003.9	739.68	5320.9	655.11
21	78.6	82.46	44.4	09.82	41.5	10.94	33.6	32.46	04.9	40.17	22.3	55.49
22	79.6	82.93	45.9	10.20	42.5	11.42	35.1	32.84	06.0	40.67	23.8	55.88
23	80.7	83.40	47.4	10.57	43.6	11.90	36.5	33.22	07.1	41.16	25.3	56.27
24	81.7	83.86	48.9	10.94	44.6	12.38	38.0	33.61	08.1	41.65	26.8	56.65
25	82.8	84.33	50.4	11.32	45.7	12.86	39.5	33.99	09.2	42.15	28.2	57.04
26	83.8	84.80	51.9	11.69	46.7	13.35	41.0	34.37	10.3	42.64	29.7	57.43
27	84.8	85.27	53.3	12.07	47.8	13.83	42.5	34.75	11.3	43.14	31.2	57.82
28	85.9	85.74	54.8	12.44	48.9	14.31	44.0	35.13	12.4	43.63	32.7	58.20
29	86.9	86.21	56.3	12.82	49.9	14.79	45.4	35.51	13.5	44.13	34.1	58.59
30	2888.0	686.68	515.9	613.19	2951.0	715.28	5246.9	635.89	3015.5	744.62	5335.6	658.98
31	89.0	87.15	58.8	13.57	52.0	15.76	48.4	36.27	15.6	45.12	37.1	59.37
32	90.1	87.62	60.8	13.94	53.1	16.24	49.9	36.66	16.6	45.61	38.6	59.76
33	91.1	88.09	62.3	14.32	54.1	16.73	51.4	37.04	17.7	46.11	40.0	60.15
34	92.2	88.57	63.8	14.69	55.2	17.21	52.8	37.42	18.8	46.61	41.5	60.53
35	93.2	89.04	65.3	15.07	56.2	17.69	54.3	37.80	19.8	47.10	43.0	60.92
36	94.3	89.51	66.7	15.45	57.3	18.18	55.8	38.18	20.9	47.60	44.5	61.31
37	95.3	89.98	68.2	15.82	58.3	18.66	57.3	38.57	22.0	48.09	45.9	61.70
38	96.3	90.45	69.7	16.20	59.4	19.15	58.8	38.95	23.0	48.59	47.4	62.09
39	97.4	90.92	71.2	16.57	60.5	19.63	60.2	39.33	24.1	49.09	48.9	62.48
40	2898.4	691.40	517.2	616.95	2961.5	720.12	5261.7	639.71	3025.2	749.59	5350.4	662.87
41	99.5	91.87	74.2	17.33	62.6	20.60	63.2	40.10	26.2	50.08	51.8	63.25
42	2908.5	92.34	75.7	17.70	63.6	21.08	64.7	40.48	27.3	50.58	53.3	63.64
43	01.6	92.82	77.2	18.08	64.7	21.57	66.2	40.86	28.4	51.08	54.8	64.03
44	02.6	93.29	78.6	18.45	65.7	22.06	67.6	41.25	29.4	51.58	56.3	64.42
45	03.7	93.76	80.1	18.83	66.8	22.54	69.1	41.63	30.5	52.08	57.7	64.81
46	04.7	94.23	81.6	19.21	67.9	23.03	70.6	42.01	31.6	52.58	59.2	65.20
47	05.8	94.71	83.1	19.59	68.9	23.51	72.1	42.39	32.6	53.07	60.7	65.59
48	06.8	95.18	84.6	19.96	70.0	24.00	73.6	42.78	33.7	53.57	62.1	65.98
49	07.9	95.66	86.1	20.34	71.0	24.49	75.0	43.16	34.8	54.07	63.6	66.37
50	2908.9	696.13	518.76	620.72	2972.1	724.97	5276.5	643.55	3035.8	754.57	5365.1	666.76
51	10.0	96.61	89.0	21.09	73.1	25.46	76.0	43.93	36.9	55.07	66.6	67.15
52	11.0	97.08	90.5	21.47	74.2	25.95	77.5	44.31	38.0	55.57	68.0	67.54
53	12.1	97.56	92.0	21.85	75.3	26.44	79.0	44.70	39.0	56.07	69.5	67.93
54	13.1	98.03	93.5	22.23	76.3	26.92	80.4	45.08	40.1	56.57	71.0	68.32
55	14.2	98.51	95.0	22.60	77.4	27.41	81.9	45.47	41.2	57.07	72.5	68.71
56	15.2	98.98	96.5	22.98	78.4	27.90	83.4	45.85	42.2	57.57	73.9	69.10
57	16.3	99.46	98.0	23.36	79.5	28.39	84.9	46.23	43.3	58.08	75.4	69.50
58	17.3	99.93	99.4	23.74	80.5	28.88	86.4	46.62	44.4	58.58	76.9	69.89
59	18.4	100.41	5200.9	24.12	81.6	29.37	87.8	47.00	45.4	59.08	78.3	70.28

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

37

56°				57°				58°				
T	E	C	M	T	E	C	M	T	E	C	M	/
1046.5	75.958	5379.8	670.67	3110.9	790.08	5467.9	624.33	3176.0	821.37	5555.6	778.38	0
476	60.08	81.3	71.06	12.0	90.60	69.4	94.73	77.1	21.90	57.0	18.79	1
486	60.58	82.8	71.45	13.1	91.11	70.8	95.13	78.2	22.42	58.5	19.19	2
497	61.09	84.2	71.84	14.2	91.63	72.3	95.83	79.3	22.95	60.0	19.60	3
508	61.59	85.7	72.23	15.3	92.14	73.8	96.53	80.4	23.48	61.4	20.00	4
519	62.09	87.2	72.63	16.3	92.66	75.2	96.33	81.4	24.01	62.9	20.41	5
529	62.60	88.6	73.02	17.4	93.17	76.7	96.72	82.5	24.54	64.3	20.81	6
54.0	63.10	90.1	73.41	18.5	93.69	78.2	97.12	83.6	25.07	65.8	21.22	7
55.1	63.60	91.6	73.80	19.6	94.21	79.6	97.52	84.7	25.60	67.2	21.62	8
56.1	64.11	93.1	74.20	20.7	94.72	81.1	97.92	85.8	26.13	68.7	22.03	9
30572	764.61	5394.5	674.59	321.7	795.24	5482.5	698.32	3186.9	826.66	5570.2	722.43	10
58.3	65.11	96.0	74.98	22.8	95.76	84.0	98.72	88.0	27.19	71.6	22.84	11
59.3	65.62	97.5	75.37	23.9	96.27	85.5	99.11	89.1	27.72	73.1	23.24	12
60.4	66.12	98.9	75.76	25.0	96.79	86.9	99.51	90.2	28.25	74.5	23.65	13
61.5	66.63	5400.4	76.16	26.1	97.31	88.4	99.91	91.3	28.79	76.0	24.05	14
62.6	67.13	01.9	76.55	27.2	97.83	89.9	700.31	92.4	29.32	77.4	24.46	15
63.6	67.64	03.3	76.94	28.2	98.35	91.3	00.71	93.5	29.85	78.9	24.86	16
64.7	68.14	04.8	77.34	29.3	98.86	92.8	01.11	94.5	30.38	80.3	25.27	17
65.8	68.65	06.3	77.73	30.4	99.38	94.3	01.51	95.6	30.91	81.8	25.67	18
66.8	69.15	07.8	78.12	31.5	99.90	95.7	01.91	96.7	31.44	83.3	26.08	19
3067.9	769.66	5409.2	678.52	332.6	800.42	5497.2	702.31	3197.8	831.98	5584.7	726.49	20
69.0	70.16	10.7	78.91	33.6	00.94	98.6	02.71	98.9	32.51	86.2	26.89	21
70.1	70.67	12.2	79.30	34.7	01.46	5500.1	03.11	3200.0	33.04	87.6	27.30	22
71.1	71.18	13.6	79.70	35.8	01.98	01.6	03.51	01.1	33.58	89.1	27.71	23
72.2	71.69	15.1	80.09	36.9	02.50	03.0	03.91	02.2	34.11	90.5	28.11	24
73.3	72.19	16.6	80.48	38.0	03.02	04.5	04.31	03.3	34.64	92.0	28.52	25
74.4	72.70	18.0	80.88	39.1	03.54	05.9	04.71	04.4	35.18	93.4	28.93	26
75.4	73.21	19.5	81.27	40.1	04.06	07.4	05.11	05.5	35.71	94.9	29.33	27
76.5	73.72	21.0	81.67	41.2	04.58	08.9	05.51	06.6	36.24	96.3	29.74	28
77.6	74.22	22.4	82.06	42.3	05.10	10.3	05.91	07.7	36.78	97.8	30.15	29
3078.7	747.77	5423.9	682.44	343.4	805.63	5511.8	706.31	3208.8	837.31	5599.3	730.55	30
79.7	75.24	25.4	82.85	44.5	06.15	13.3	06.71	09.9	37.35	5600.7	30.96	31
80.8	75.75	26.8	83.24	45.6	06.67	14.7	07.11	10.9	38.38	02.2	31.37	32
81.9	76.26	28.3	83.64	46.6	07.19	16.2	07.52	12.0	38.92	03.6	31.78	33
82.9	76.77	29.8	84.03	47.7	07.71	17.6	07.92	13.1	39.46	05.1	32.18	34
84.0	77.28	31.3	84.43	48.8	08.23	19.1	08.32	14.2	39.99	06.5	32.59	35
85.1	77.79	32.7	84.82	49.9	08.76	20.6	08.72	15.3	40.53	08.0	33.00	36
86.2	78.30	34.2	85.22	51.0	09.28	22.0	09.12	16.4	41.06	09.4	33.41	37
87.2	78.81	35.7	85.61	52.1	09.80	23.5	09.52	17.5	41.60	10.9	33.81	38
88.3	79.32	37.1	86.01	53.2	10.33	24.9	09.92	18.6	42.14	12.3	34.22	39
3089.4	779.83	5438.6	686.40	354.2	810.85	5526.4	710.33	3219.7	842.67	5613.8	734.63	40
90.5	80.34	40.1	86.80	55.3	11.37	27.9	10.73	20.8	43.21	15.2	35.04	41
91.6	80.85	41.5	87.20	56.4	11.90	29.3	11.13	21.9	43.75	16.7	35.45	42
92.6	81.36	43.0	87.59	57.5	12.42	30.8	11.53	23.0	44.29	18.2	35.86	43
93.7	81.87	44.5	87.99	58.6	12.95	32.2	11.93	24.1	44.83	19.6	36.26	44
94.8	82.38	45.9	88.38	59.7	13.47	33.7	12.34	25.2	45.36	21.1	36.67	45
95.9	82.89	47.4	88.78	60.8	14.00	35.2	12.74	26.3	45.90	22.5	37.08	46
96.9	83.40	48.9	89.18	61.8	14.52	36.6	13.14	27.4	46.44	24.0	37.49	47
98.0	83.92	50.3	89.57	62.9	15.05	38.1	13.50	28.5	46.98	25.4	37.90	48
99.1	84.43	51.8	89.97	64.0	15.57	39.5	13.95	29.6	47.52	26.9	38.31	49
3100.3	784.94	5453.3	690.36	365.1	816.10	5541.0	714.35	3230.7	848.06	5628.3	738.72	50
01.2	85.45	54.7	90.76	66.2	16.62	42.5	14.75	31.8	48.60	28.8	39.13	51
02.3	85.97	56.2	91.16	67.3	17.15	43.9	15.15	32.9	49.14	31.2	39.54	52
03.4	86.48	57.7	91.55	68.4	17.68	45.4	15.56	34.0	49.68	32.7	39.95	53
04.5	87.00	59.1	91.95	69.5	18.20	46.8	15.96	35.1	50.22	34.1	40.36	54
05.6	87.51	60.6	92.35	70.6	18.73	48.3	16.37	36.2	50.76	35.6	40.77	55
06.7	88.02	62.0	92.75	71.6	19.26	49.7	16.77	37.3	51.30	37.0	41.18	56
07.7	88.54	63.5	93.14	72.7	19.79	51.2	17.17	38.4	51.84	38.5	41.59	57
08.8	89.05	65.0	93.54	73.8	20.31	52.7	17.58	39.5	52.38	39.9	42.00	58
09.9	89.57	66.4	93.94	74.9	20.84	54.1	17.98	40.6	52.92	41.4	42.41	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	59°				60°				61°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	3241.7	853.46	5642.8	742.82	3308.0	886.38	5729.7	7676.3	3375.0	920.14	5876.0	792.82
1	42.8	54.01	44.3	43.23	09.1	86.94	31.1	68.04	76.1	20.71	17.5	93.24
2	43.9	54.55	45.7	43.64	10.2	87.49	32.5	68.46	77.3	21.28	18.9	93.66
3	45.0	55.09	47.2	44.05	11.3	88.05	34.0	68.88	78.4	21.85	20.3	94.09
4	46.1	55.63	48.6	44.46	12.5	88.60	35.4	69.30	79.5	22.42	21.8	94.51
5	47.2	56.18	50.1	44.87	13.6	89.16	36.9	69.71	80.6	22.99	23.2	94.93
6	48.3	56.72	51.5	45.28	14.7	89.72	38.3	70.13	81.8	23.56	24.6	95.36
7	49.4	57.26	53.0	45.69	15.8	90.27	39.8	70.55	82.9	24.13	26.1	95.78
8	50.5	57.80	54.4	46.10	16.9	90.83	41.2	70.96	84.0	24.70	27.5	96.20
9	51.6	58.35	55.9	46.51	18.0	91.39	42.6	71.38	85.1	25.27	29.0	96.63
10	3252.7	858.89	5657.3	746.93	3319.1	891.95	5744.1	771.80	3386.3	925.84	5830.4	797.05
11	53.8	59.44	58.8	47.34	20.2	92.50	45.5	72.21	87.4	26.42	31.8	97.47
12	54.9	59.98	60.2	47.75	21.4	93.06	47.0	72.63	88.5	26.99	33.3	97.90
13	56.0	60.52	61.7	48.16	22.5	93.62	48.4	73.05	89.6	27.56	34.7	98.32
14	57.1	61.07	63.1	48.57	23.6	94.18	49.8	73.47	90.7	28.13	36.1	98.75
15	58.2	61.61	64.6	48.98	24.7	94.74	51.3	73.89	91.9	28.71	37.6	99.17
16	59.3	62.16	66.0	49.40	25.8	95.30	52.7	74.31	93.0	29.28	39.0	99.60
17	60.4	62.71	67.5	49.81	26.9	95.86	54.2	74.73	94.1	29.86	40.4	100.02
18	61.5	63.25	68.9	50.22	28.0	96.42	55.6	75.15	95.3	30.43	41.9	100.45
19	62.6	63.80	70.4	50.63	29.2	96.98	57.1	75.56	96.8	31.00	43.3	100.87
20	3263.7	864.34	5671.8	751.05	3330.3	897.44	5758.5	775.98	3397.5	931.58	5844.7	801.30
21	64.8	64.89	73.3	51.46	31.4	98.10	59.9	76.40	98.6	32.15	46.2	101.72
22	65.9	65.44	74.7	51.87	32.5	98.66	61.4	76.82	99.9	32.73	47.6	102.15
23	67.0	65.98	76.2	52.28	33.6	99.22	62.8	77.24	100.0	33.30	49.0	102.57
24	68.1	66.53	77.6	52.70	34.7	99.78	64.3	77.66	101.0	33.88	50.5	103.00
25	69.2	67.08	79.1	53.11	35.9	100.34	65.7	78.08	102.1	34.45	51.9	103.42
26	70.3	67.62	80.5	53.52	37.0	100.90	67.1	78.50	103.3	35.03	53.3	103.85
27	71.4	68.17	82.0	53.94	38.1	101.47	68.6	78.92	104.4	35.61	54.8	104.27
28	72.5	68.72	83.4	54.35	39.2	102.03	70.0	79.33	105.5	36.18	56.2	104.70
29	73.7	69.27	84.8	54.76	40.3	102.59	71.5	79.75	107.7	36.76	57.6	105.13
30	3274.8	869.82	5686.3	755.17	3341.4	903.15	5772.9	780.17	3408.8	937.34	5859.1	805.55
31	75.9	70.37	87.7	55.59	42.6	103.72	74.3	80.59	109.9	37.91	60.5	105.98
32	77.0	70.92	89.2	56.00	43.7	104.28	75.8	81.01	110.0	38.49	61.9	106.40
33	78.1	71.46	90.6	56.42	44.8	104.84	77.2	81.43	112.2	39.07	63.4	106.83
34	79.2	72.01	92.1	56.83	45.9	105.41	78.7	81.85	113.3	39.65	64.8	107.26
35	80.3	72.56	93.5	57.24	47.0	105.97	80.1	82.28	114.4	40.22	66.2	107.68
36	81.4	73.11	95.0	57.66	48.1	106.53	81.5	82.70	115.6	40.80	67.7	108.11
37	82.5	73.66	96.4	58.07	49.3	107.09	83.0	83.12	116.7	41.38	69.1	108.54
38	83.6	74.21	97.9	58.49	50.4	107.66	84.4	83.54	117.8	41.96	70.5	108.96
39	84.7	74.76	99.3	58.90	51.5	108.22	85.9	83.96	118.9	42.54	71.9	109.39
40	3285.8	875.31	5700.8	759.32	3352.6	908.79	5787.3	784.36	3420.1	943.12	5873.4	809.82
41	86.9	75.87	102.3	59.73	53.7	109.35	87.7	84.80	121.2	43.70	74.8	110.24
42	88.0	76.42	103.6	60.14	54.8	109.92	89.2	85.22	122.3	44.28	76.2	110.67
43	89.2	76.97	105.1	60.56	56.0	110.49	91.6	85.64	123.5	44.86	77.7	111.10
44	90.3	77.52	106.5	60.97	57.1	111.05	93.0	86.06	124.6	45.44	79.1	111.53
45	91.4	78.07	108.0	61.39	58.2	111.62	94.5	86.48	125.7	46.02	80.5	111.96
46	92.5	78.62	109.4	61.80	59.3	112.18	95.9	86.90	126.9	46.60	82.0	112.38
47	93.6	79.18	110.9	62.22	60.4	112.75	97.4	87.33	128.0	47.18	83.4	112.81
48	94.7	79.73	112.3	62.64	61.6	113.32	98.8	87.75	129.1	47.76	84.8	113.24
49	95.8	80.28	113.8	63.05	62.7	113.89	100.2	88.17	130.3	48.34	86.3	113.67
50	3296.9	880.84	5715.2	763.47	3363.8	914.45	5802.1	788.59	3431.4	948.92	5887.7	814.09
51	98.0	81.39	116.7	64.88	64.9	115.02	101.7	89.01	132.5	49.52	88.1	114.51
52	99.1	81.94	118.1	65.30	66.0	115.59	103.1	89.44	133.7	50.09	89.5	114.95
53	3300.2	82.50	119.5	65.71	67.2	116.15	104.5	89.86	134.9	50.67	91.0	115.38
54	101.4	83.05	121.0	66.13	68.3	116.72	105.9	90.28	135.9	51.25	92.4	115.81
55	102.5	83.61	122.4	66.55	69.4	117.29	107.3	90.70	137.1	51.83	93.8	116.24
56	103.6	84.16	123.9	66.96	70.5	117.86	108.7	91.12	138.2	52.42	95.3	116.67
57	104.7	84.71	125.3	67.38	71.7	118.43	110.1	91.55	139.3	53.00	96.7	117.09
58	105.8	85.27	126.8	67.79	72.8	119.00	111.5	91.97	140.5	53.58	98.1	117.52
59	106.9	85.82	128.3	68.21	73.9	119.57	112.9	92.39	141.6	54.17	99.5	117.95

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

62°				63°				64°				I
T	E	C	M	T	E	C	M	T	E	C	M	
3442.7	954.75	5902.0	818.38	3511.1	990.24	5987.5	844.12	3580.3	1026.6	6072.5	870.83	0
419	53.31	69.4	18.81	15.3	30.84	88.9	44.76	81.4	27.2	73.9	71.07	1
450	53.92	04.8	19.24	15.4	31.42	89.3	45.19	82.6	27.9	75.3	71.52	2
461	56.50	06.3	19.67	14.6	32.04	91.7	45.63	83.8	28.5	76.7	71.96	3
473	57.09	07.7	20.10	15.7	32.64	93.2	46.06	84.9	29.1	78.2	72.40	4
484	57.67	09.1	20.53	16.9	33.24	94.6	46.50	86.1	29.7	79.6	72.84	5
495	58.26	10.5	20.96	18.0	33.84	96.0	46.93	87.2	30.3	81.0	73.28	6
507	58.85	12.0	21.39	19.2	34.44	97.4	47.37	88.4	30.9	82.4	73.72	7
518	59.43	13.4	21.82	20.3	35.04	98.8	47.81	89.6	31.5	83.8	74.17	8
529	60.02	14.8	22.25	21.5	35.64	6000.3	48.24	90.7	32.2	85.2	74.61	9
3454.1	9606.1	5916.3	822.68	3522.6	996.24	6001.7	848.68	3591.9	1032.8	6086.6	875.05	10
532	61.19	17.7	23.11	23.8	96.85	03.1	49.12	93.0	33.4	88.0	75.49	11
563	61.78	19.1	23.54	24.9	97.45	04.5	49.55	94.2	34.0	89.5	75.94	12
575	62.37	20.5	23.97	26.1	98.05	05.9	49.99	95.4	34.6	90.9	76.38	13
586	62.95	21.0	24.40	27.2	98.65	07.4	50.43	96.5	35.3	92.3	76.82	14
598	63.54	23.4	24.83	28.4	99.25	08.8	50.86	97.7	35.9	93.7	77.27	15
609	64.13	24.8	25.26	29.5	99.86	10.2	51.30	98.8	36.5	95.1	77.71	16
620	64.72	26.2	25.69	30.7	1000.5	11.6	51.74	3600.0	37.1	96.5	78.15	17
632	65.31	27.7	26.12	31.8	01.1	13.0	52.17	01.2	37.7	97.9	78.60	18
643	65.89	29.1	26.55	33.0	01.7	14.4	52.61	02.3	38.3	99.3	79.04	19
34654	966.48	5930.5	826.99	3534.1	1002.3	6015.9	853.05	3603.5	1039.0	6100.7	879.48	20
666	67.07	31.9	27.42	35.3	02.9	17.3	53.49	04.7	39.6	02.2	79.93	21
677	67.66	33.4	27.85	36.4	03.5	18.7	53.92	05.8	40.2	03.6	80.37	22
689	68.25	34.8	28.28	37.6	04.1	20.1	54.36	07.0	40.8	05.0	80.82	23
700	68.84	36.2	28.71	38.7	04.7	21.5	54.80	08.2	41.4	06.4	81.26	24
711	69.43	37.7	29.14	39.9	05.3	23.0	55.24	09.3	42.1	07.8	81.70	25
723	70.02	39.1	29.58	41.0	05.9	24.4	55.68	10.5	42.7	09.2	82.15	26
734	70.61	40.5	30.01	42.2	06.5	25.8	56.11	11.6	43.3	10.5	82.59	27
746	71.20	41.9	30.44	43.3	07.1	27.2	56.55	12.8	43.9	12.0	83.04	28
757	71.79	43.4	30.87	44.5	07.7	28.6	56.99	14.0	44.5	13.4	83.48	29
3476.8	972.39	5944.8	831.30	3545.6	1008.3	6030.0	857.43	3615.1	1045.2	6114.8	883.93	30
760	72.38	46.2	31.74	46.8	08.9	31.5	57.87	16.3	45.8	16.3	84.37	31
791	73.57	47.6	32.17	47.9	09.5	32.9	58.31	17.5	46.4	17.7	84.81	32
803	74.16	49.1	32.60	49.1	10.1	34.3	58.74	18.6	47.0	19.1	85.26	33
814	74.75	50.5	33.03	50.2	10.8	35.7	59.18	19.8	47.7	20.5	85.70	34
825	75.35	51.9	33.47	51.4	11.4	37.1	59.62	21.0	48.3	21.9	86.15	35
837	75.94	53.3	33.90	52.5	12.0	38.5	60.06	22.1	48.9	23.3	86.59	36
848	76.53	54.7	34.33	53.7	12.6	40.0	60.50	23.3	49.5	24.7	87.04	37
860	77.12	56.2	34.77	54.8	13.2	41.4	60.94	24.5	50.1	26.1	87.49	38
871	77.72	57.6	35.20	56.0	13.8	42.8	61.38	25.6	50.8	27.5	87.93	39
34882	978.31	5959.0	835.63	3557.2	1014.4	6044.2	861.81	3626.8	1051.4	6128.9	888.38	40
894	78.91	60.4	36.07	58.3	15.0	45.6	62.26	28.0	52.0	30.3	88.82	41
905	79.50	61.9	36.50	59.5	15.6	47.0	62.70	29.1	52.6	31.8	89.27	42
917	80.10	63.3	36.93	60.6	16.2	48.5	63.14	30.3	53.3	33.2	89.72	43
928	80.69	64.7	37.37	61.8	16.8	49.9	63.58	31.5	53.9	34.6	90.16	44
940	81.29	66.1	37.80	62.9	17.4	51.3	64.02	32.6	54.5	36.0	90.61	45
951	81.88	67.6	38.23	64.1	18.1	52.7	64.46	33.8	55.1	37.4	91.05	46
962	82.48	69.0	38.67	65.2	18.7	54.1	64.90	35.0	55.8	38.8	91.50	47
974	83.07	70.4	39.10	66.4	19.3	55.5	65.34	36.1	56.4	40.2	91.95	48
985	83.67	71.8	39.54	67.5	19.9	56.9	65.78	37.3	57.0	41.6	92.39	49
3499.7	984.27	5973.3	839.97	3568.7	1020.5	6058.4	866.22	3638.5	1057.7	6143.0	892.84	50
3500.8	984.86	74.7	40.40	69.9	21.1	59.8	66.66	39.7	58.3	44.4	93.39	51
02.0	85.46	76.1	40.84	71.0	21.7	61.2	67.10	40.8	58.9	45.8	93.83	52
03.1	86.05	77.5	41.27	72.2	22.3	62.6	67.54	42.0	59.5	47.2	94.28	53
043	86.65	78.9	41.71	73.3	22.9	64.0	67.98	43.2	60.2	48.6	94.73	54
054	87.25	80.4	42.14	74.5	23.6	65.4	68.42	44.3	60.8	50.0	95.17	55
066	87.85	81.8	42.58	75.6	24.2	66.8	68.87	45.5	61.4	51.5	95.62	56
077	88.45	83.2	43.01	76.8	24.8	68.3	69.31	46.7	62.0	52.9	95.97	57
088	89.04	84.6	43.45	78.0	25.4	69.7	69.75	47.8	62.7	54.3	96.42	58
10.0	89.64	86.0	43.88	79.1	26.0	71.1	70.19	49.0	63.3	55.7	96.86	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

°	65°				66°				67°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	3650.2	1063.9	6157.1	8923.1	3720.9	1102.2	6241.2	9243.6	3792.4	1141.4	6324.8	9517.8
1	51.4	64.6	58.5	97.76	22.1	02.8	42.6	24.82	93.6	42.0	26.2	52.24
2	52.5	65.2	59.9	98.21	23.2	03.5	44.0	25.27	94.8	42.7	27.6	52.70
3	53.7	65.8	61.3	98.66	24.4	04.1	45.4	25.72	96.0	43.4	29.0	53.16
4	54.9	66.5	62.7	99.10	25.6	04.8	46.8	26.18	97.2	44.0	30.4	53.62
5	56.1	67.1	64.1	99.55	26.8	05.4	48.2	26.63	98.4	44.7	31.8	54.08
6	57.2	67.7	65.5	99.90	28.0	06.1	49.6	27.09	99.6	45.3	33.1	54.54
7	58.4	68.3	66.9	99.95	29.2	06.7	51.0	27.54	380.08	46.0	34.5	55.00
8	59.6	69.0	68.3	99.90	30.4	07.3	52.4	28.00	02.0	46.7	35.9	55.46
9	60.7	69.6	69.7	99.95	31.6	08.0	53.8	28.45	03.2	47.3	37.3	55.92
10	3661.9	1070.2	6171.1	901.80	3732.7	1108.6	6255.2	9289.0	3804.4	1148.0	6338.7	956.38
11	63.1	70.9	72.5	02.24	33.9	09.3	56.5	29.36	05.6	48.7	40.1	56.84
12	64.3	71.5	73.9	02.69	35.1	09.9	57.9	29.81	06.8	49.3	41.5	57.30
13	65.4	72.1	75.3	03.14	36.3	10.6	59.3	30.27	08.0	50.0	42.9	57.76
14	66.6	72.8	76.7	03.59	37.5	11.2	60.7	30.72	09.2	50.7	44.3	58.23
15	67.8	73.4	78.1	04.04	38.7	11.9	62.1	31.18	10.4	51.3	45.6	58.69
16	69.0	74.0	79.6	04.49	39.9	12.5	63.5	31.64	11.6	52.0	47.0	59.15
17	70.1	74.7	81.0	04.94	41.1	13.1	64.9	32.09	12.8	52.7	48.4	59.61
18	71.3	75.3	82.4	05.39	42.2	13.8	66.3	32.55	14.0	53.3	49.8	60.07
19	72.5	75.9	83.8	05.84	43.4	14.5	67.7	33.00	15.2	54.0	51.2	60.53
20	3673.7	1076.6	6185.2	906.29	3744.6	1115.1	6269.1	933.46	3816.4	1154.7	6352.6	960.99
21	74.8	77.2	86.6	06.74	45.8	15.8	70.5	33.91	17.6	55.3	54.0	61.46
22	76.0	77.8	88.0	07.19	47.0	16.4	71.9	34.37	18.8	56.0	55.4	61.92
23	77.2	78.5	89.4	07.64	48.2	17.1	73.3	34.83	20.0	56.7	56.7	62.38
24	78.4	79.1	90.8	08.09	49.4	17.7	74.7	35.28	21.2	57.3	58.1	62.84
25	79.5	79.8	92.2	08.54	50.6	18.4	76.1	35.74	22.4	58.0	59.5	63.31
26	80.7	80.4	93.6	08.99	51.8	19.0	77.5	36.20	23.6	58.7	60.9	63.77
27	81.9	81.0	95.0	09.44	52.9	19.7	78.9	36.65	24.8	59.3	62.3	64.23
28	83.1	81.7	96.4	09.89	54.1	20.3	80.3	37.11	26.0	60.0	63.7	64.69
29	84.3	82.3	97.8	10.34	55.3	21.0	81.7	37.57	27.2	60.7	65.1	65.16
30	3685.4	1082.9	6199.2	910.79	3756.5	1121.7	6283.1	938.02	3828.4	1161.3	6366.4	965.62
31	86.6	83.6	6200.6	11.24	57.7	22.3	84.5	38.48	29.4	62.0	67.8	66.08
32	87.8	84.2	62.0	11.69	58.9	23.0	85.9	38.94	30.6	62.7	69.2	66.55
33	89.0	84.8	63.4	12.14	60.1	23.6	87.2	39.39	32.0	63.4	70.6	67.01
34	90.1	85.5	64.8	12.59	61.3	24.3	88.6	39.85	33.3	64.0	72.0	67.47
35	91.3	86.1	66.2	13.05	62.5	24.9	90.0	40.31	34.5	64.7	73.4	67.94
36	92.5	86.8	67.6	13.50	63.7	25.6	91.4	40.77	35.7	65.4	74.8	68.40
37	93.7	87.4	69.0	13.95	64.9	26.2	92.8	41.22	36.9	66.0	76.1	68.86
38	94.9	88.0	70.4	14.40	66.1	26.9	94.2	41.68	38.1	66.7	77.5	69.33
39	96.0	88.7	71.8	14.85	67.3	27.5	95.6	42.14	39.3	67.4	78.9	69.79
40	3697.2	1089.3	6213.2	915.30	3768.5	1128.2	6297.0	942.60	3840.5	1168.8	6380.3	970.26
41	98.4	90.0	14.6	15.76	68.6	28.9	98.4	43.06	41.7	68.7	81.7	70.72
42	99.6	90.6	16.0	16.21	70.8	29.5	99.8	43.51	42.9	69.4	83.1	71.18
43	3700.8	91.2	17.4	16.66	72.0	30.2	630.15	43.97	44.1	70.1	84.5	71.65
44	02.0	91.9	18.8	17.11	73.2	30.8	02.6	44.43	45.3	70.7	85.8	72.11
45	03.1	92.5	20.2	17.56	74.4	31.5	03.9	44.89	46.5	71.4	87.2	72.58
46	04.3	93.2	21.6	18.02	75.6	32.1	05.3	45.35	47.7	72.1	88.6	73.04
47	05.5	93.8	23.0	18.47	76.8	32.8	06.7	45.80	49.0	72.8	90.0	73.51
48	06.7	94.5	24.4	18.92	78.0	33.5	08.1	46.26	50.2	73.4	91.4	73.97
49	07.9	95.1	25.8	19.37	79.2	34.1	09.5	46.72	51.4	74.1	92.8	74.44
50	3709.0	1095.7	6227.2	919.83	3780.4	1134.8	6310.9	947.18	3852.6	1174.8	6394.1	974.90
51	10.2	96.4	28.6	20.28	81.6	35.4	12.3	47.64	53.8	75.5	95.5	75.37
52	11.4	97.0	30.0	20.73	82.8	36.1	13.7	48.10	55.0	76.1	96.9	75.83
53	12.6	97.7	31.4	21.19	84.0	36.8	15.1	48.56	56.2	76.8	98.3	76.30
54	13.8	98.3	32.8	21.64	85.2	37.4	16.5	49.02	57.4	77.5	99.7	76.76
55	15.0	99.0	34.2	22.09	86.4	38.1	17.9	49.48	58.6	78.2	640.0	77.23
56	16.1	99.6	35.6	22.55	87.6	38.7	19.2	49.94	59.8	78.9	02.4	77.69
57	17.3	100.2	37.0	23.00	88.8	39.4	20.6	50.40	61.1	79.5	03.8	78.16
58	18.5	00.9	38.4	23.45	90.0	40.1	22.0	50.86	62.3	80.2	05.2	78.62
59	19.7	01.5	39.8	23.91	91.2	40.7	23.4	51.32	63.5	80.9	06.6	79.09

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

41

68°				69°				70°				
T	E	C	M	T	E	C	M	T	E	C	M	'
386.7	1181.6	6408.0	979.56	393.73	1212.7	6490.6	1007.7	4011.9	1265.0	6572.8	1036.2	0
65.9	82.2	09.3	80.02	39.1	23.4	92.0	08.2	13.2	65.7	74.2	36.7	1
67.1	83.9	10.7	80.49	40.3	24.1	93.4	08.6	14.4	66.9	75.5	37.2	2
68.3	85.6	12.1	80.95	41.6	24.8	94.7	09.1	15.7	67.1	76.9	37.6	3
69.5	87.3	13.5	81.42	42.8	25.5	96.1	09.6	16.9	67.8	78.2	38.1	4
70.8	89.0	14.9	81.89	44.0	26.2	97.5	10.1	18.2	68.5	79.6	38.6	5
72.0	90.6	16.2	82.35	45.2	26.9	98.9	10.5	19.4	69.2	81.0	39.1	6
73.2	92.3	17.6	82.82	46.5	27.6	6500.2	11.0	20.6	70.0	82.3	39.5	7
74.4	94.0	19.0	83.29	47.7	28.3	01.6	11.5	21.9	70.7	83.7	40.0	8
75.6	95.7	20.4	83.75	48.9	29.0	03.0	11.9	23.1	71.4	85.1	40.5	9
387.8	1188.4	6421.8	984.22	395.02	1229.7	6504.3	1012.4	4024.4	1272.1	6586.4	1041.0	10
78.0	89.0	23.2	84.69	51.4	30.4	05.7	12.9	25.6	72.8	87.8	41.5	11
79.3	89.7	24.5	85.15	52.6	31.1	07.1	13.4	26.9	73.5	89.2	41.9	12
80.5	90.4	25.9	85.62	53.9	31.8	08.5	13.8	28.1	74.2	90.5	42.4	13
81.7	91.1	27.3	86.09	55.1	32.5	09.8	14.3	29.4	75.0	91.9	42.9	14
82.9	91.8	28.7	86.56	56.3	33.2	11.2	14.8	30.6	75.7	93.2	43.4	15
84.1	92.4	30.0	87.02	57.5	33.9	12.6	15.3	31.8	76.4	94.6	43.9	16
85.3	93.1	31.4	87.49	58.8	34.6	14.0	15.7	33.1	77.1	96.0	44.3	17
86.6	93.8	32.8	87.96	60.0	35.3	15.3	16.2	34.3	77.8	97.3	44.8	18
87.8	94.5	34.3	88.43	61.2	36.0	16.7	16.7	35.6	78.5	98.7	45.3	19
389.0	1195.2	6435.6	988.89	396.25	1236.7	6518.1	1017.2	4036.8	1279.3	6600.1	1045.8	20
90.2	95.9	36.9	89.36	63.7	37.4	19.4	17.6	38.1	80.0	01.4	46.3	21
91.4	96.5	38.3	89.83	64.9	38.1	20.8	18.1	39.3	80.7	02.8	46.7	22
92.6	97.2	39.7	90.30	66.2	38.8	22.2	18.6	40.6	81.4	04.1	47.2	23
93.9	97.9	41.1	90.77	67.4	39.5	23.5	19.1	41.8	82.1	05.5	47.7	24
95.1	98.6	42.5	91.24	68.6	40.2	24.9	19.5	43.1	82.8	06.9	48.2	25
96.3	99.3	43.8	91.70	69.9	40.9	26.3	20.0	44.3	83.6	08.2	48.7	26
97.5	1200.0	45.2	92.17	71.1	41.6	27.7	20.5	45.6	84.3	09.6	49.1	27
98.7	00.7	46.6	92.64	72.3	42.3	29.0	21.0	46.8	85.0	11.0	49.6	28
390.0	01.3	48.0	93.11	73.6	43.0	30.4	21.4	48.1	85.7	12.3	50.1	29
3901.2	1202.0	6449.4	993.58	397.48	1243.7	6531.8	1021.9	4049.3	1286.5	6613.7	1050.6	30
02.4	02.7	50.7	94.05	76.0	44.4	33.1	22.4	50.6	87.2	15.0	51.1	31
03.6	03.4	52.1	94.52	77.3	45.1	34.5	22.9	51.8	87.9	16.4	51.5	32
04.8	04.1	53.5	94.99	78.5	45.8	35.9	23.3	53.1	88.6	17.8	52.0	33
06.1	04.8	54.9	95.46	79.7	46.5	37.2	23.8	54.3	89.4	19.1	52.5	34
07.3	05.5	56.2	95.93	81.0	47.2	38.6	24.3	55.6	90.1	20.5	53.0	35
08.5	06.1	57.6	96.40	82.2	47.9	40.0	24.8	56.8	90.8	21.8	53.5	36
09.7	06.8	59.0	96.87	83.4	48.7	41.3	25.2	58.1	91.5	23.2	53.9	37
10.9	07.5	60.4	97.34	84.7	49.4	42.7	25.7	59.3	92.2	24.6	54.4	38
12.2	08.2	61.7	97.81	85.9	50.1	44.1	26.2	60.6	93.0	25.9	54.9	39
3913.4	1208.9	6463.1	998.28	398.72	1250.8	6545.5	1026.7	4061.8	1293.7	6627.3	1055.4	40
14.6	09.6	64.5	98.25	88.4	51.5	46.8	27.1	63.1	94.4	28.6	55.9	41
15.8	10.3	65.9	98.72	89.6	52.2	48.2	27.6	64.3	95.1	30.0	56.4	42
17.1	11.0	67.2	99.19	90.9	52.9	49.6	28.1	65.6	95.9	31.4	56.8	43
18.3	11.7	68.6	100.02	92.1	53.6	50.9	28.6	66.8	96.6	32.7	57.3	44
19.5	12.4	70.0	00.6	93.3	54.3	52.3	29.0	68.1	97.3	34.1	57.8	45
20.7	13.0	71.4	01.1	94.6	55.0	53.7	29.5	69.3	98.0	35.4	58.3	46
21.9	13.7	72.8	01.6	95.8	55.7	55.0	30.0	70.6	98.8	36.8	58.8	47
23.2	14.4	74.1	02.0	97.1	56.4	56.4	30.5	71.9	99.5	38.2	59.3	48
24.4	15.1	75.5	02.5	98.3	57.1	57.8	30.9	73.1	100.2	39.5	59.7	49
3925.6	1215.8	6476.9	1003.0	399.95	1257.9	6559.1	1031.4	4074.4	1300.9	6640.9	1060.2	50
26.8	16.5	78.3	03.5	400.8	58.6	60.5	31.9	75.6	01.7	42.2	60.7	51
28.1	17.2	79.6	03.9	02.0	59.3	61.9	32.4	76.9	02.4	43.6	61.2	52
29.3	17.9	81.0	04.4	03.3	60.0	63.2	32.9	78.1	03.1	44.9	61.7	53
30.5	18.6	82.4	04.9	04.5	60.7	64.6	33.3	79.4	03.9	46.3	62.2	54
31.7	19.3	83.7	05.3	05.7	61.4	66.0	33.8	80.6	04.6	47.7	62.6	55
33.0	20.0	85.1	05.8	07.0	62.1	67.3	34.3	81.9	05.3	49.0	63.1	56
34.2	20.7	86.5	06.3	08.2	62.8	68.7	34.8	83.1	06.0	50.4	63.6	57
35.4	21.4	87.9	06.8	09.5	63.5	70.1	35.2	84.4	06.8	51.7	64.1	58
36.7	22.0	89.2	07.2	10.7	64.3	71.4	35.7	85.7	07.5	53.1	64.6	59



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	71°				72°				73°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	40869	1308.2	66545	1065.1	41628	1352.6	6735.6	1094.3	4239.7	1398.0	6816.3	1123.8
1	88.2	09.0	55.8	65.5	64.1	33.3	37.0	94.8	41.0	98.8	17.6	24.3
2	89.4	09.7	57.2	66.0	65.4	34.1	38.3	95.2	42.3	99.6	18.9	24.8
3	90.7	10.4	58.5	66.5	66.7	34.8	39.7	95.7	43.6	100.4	20.3	25.3
4	92.0	11.2	59.9	67.0	67.9	35.6	41.0	96.2	44.9	01.1	21.6	25.8
5	93.2	11.9	61.2	67.5	69.2	36.3	42.3	96.7	46.2	01.9	23.0	26.3
6	94.5	12.6	62.6	68.0	70.5	37.1	43.7	97.2	47.5	02.7	24.3	26.8
7	95.7	13.4	63.9	68.4	71.8	37.8	45.0	97.7	48.8	03.4	25.6	27.3
8	97.0	14.1	65.3	68.9	73.0	38.6	46.4	98.2	50.0	04.2	27.0	27.8
9	98.2	14.8	66.7	69.4	74.3	39.3	47.7	98.7	51.3	05.0	28.3	28.3
10	40995	1315.5	6668.0	1069.9	4175.6	1360.1	6749.1	1099.2	4252.6	1405.7	6829.6	1128.8
11	4100.8	16.3	69.4	70.4	76.9	60.8	50.4	99.7	53.9	06.5	31.0	29.3
12	02.0	17.0	70.7	70.9	78.1	61.6	51.8	100.2	55.2	07.3	32.3	29.8
13	03.3	17.8	72.1	71.4	79.4	62.3	53.1	00.6	56.5	08.0	33.7	30.3
14	04.5	18.5	73.4	71.8	80.7	63.1	54.5	01.1	57.8	08.8	35.0	30.8
15	05.8	19.2	74.8	72.3	82.0	63.8	55.8	01.6	59.1	09.6	36.3	31.3
16	07.1	20.0	76.1	72.8	83.2	64.6	57.2	02.1	60.4	10.4	37.7	31.8
17	08.3	20.7	77.5	73.3	84.5	65.4	58.5	02.6	61.7	11.1	39.0	32.3
18	09.6	21.4	78.9	73.8	85.8	66.1	59.9	03.1	63.0	11.9	40.3	32.8
19	10.9	22.2	80.2	74.3	87.1	66.9	61.2	03.6	64.3	12.7	41.7	33.3
20	4112.1	1322.9	6681.6	1074.8	4188.4	1367.6	6762.5	1104.1	4265.6	1413.5	6843.0	1133.8
21	13.4	23.6	82.9	75.2	88.6	67.4	63.9	04.6	66.9	14.2	44.4	34.3
22	14.6	24.4	84.3	75.7	90.9	68.1	65.2	05.1	68.2	15.0	45.7	34.8
23	15.9	25.1	85.6	76.2	92.2	68.9	66.6	05.6	69.5	15.8	47.0	35.3
24	17.2	25.8	87.0	76.7	93.5	69.6	67.9	06.1	70.7	16.6	48.3	35.8
25	18.4	26.6	88.3	77.2	94.8	70.4	69.3	06.5	72.0	17.3	49.7	36.3
26	19.7	27.3	89.7	77.7	96.0	71.1	70.6	07.0	73.3	18.1	51.0	36.8
27	21.0	28.1	91.0	78.2	97.3	71.9	72.0	07.5	74.6	18.9	52.4	37.3
28	22.2	28.8	92.4	78.6	98.6	72.7	73.3	08.0	75.9	19.7	53.7	37.7
29	23.5	29.5	93.7	79.1	99.9	73.4	74.7	08.5	77.2	20.4	55.0	38.2
30	4124.8	1330.3	6695.1	1079.6	4201.2	1375.2	6776.0	1109.0	4278.5	1421.2	6856.4	1138.7
31	26.0	31.0	96.4	80.1	02.4	75.9	77.3	09.5	79.8	22.0	57.7	39.2
32	27.3	31.8	97.8	80.6	03.7	76.7	78.7	10.0	81.1	22.8	59.1	39.7
33	28.6	32.5	99.2	81.1	05.0	77.5	80.0	10.5	82.4	23.5	60.4	40.2
34	29.8	33.2	6700.5	81.6	06.3	78.2	81.4	11.0	83.7	24.3	61.7	40.7
35	31.1	34.0	01.9	82.1	07.6	79.0	82.7	11.5	85.0	25.1	63.1	41.2
36	32.4	34.7	02.2	82.5	08.8	79.7	84.1	12.0	86.3	25.9	64.4	41.7
37	33.6	35.5	04.6	83.0	10.1	80.5	85.4	12.5	87.6	26.6	65.7	42.2
38	34.9	36.2	05.9	83.5	11.4	81.2	86.7	13.0	88.9	27.4	67.1	42.7
39	36.2	36.9	07.3	84.0	12.7	82.0	88.1	13.4	90.2	28.2	68.4	43.2
40	4137.4	1337.7	6708.6	1084.5	4214.0	1382.8	6789.4	1113.9	4291.5	1429.0	6869.7	1143.7
41	38.7	38.4	10.6	85.0	15.3	83.5	90.8	14.4	92.8	29.8	71.4	44.2
42	40.0	39.2	11.3	85.5	16.5	84.3	92.1	14.9	94.1	30.5	72.4	44.7
43	41.2	39.9	12.7	86.0	17.8	85.1	93.5	15.4	95.4	31.3	73.7	45.2
44	42.5	40.7	14.0	86.4	19.1	85.9	94.8	15.9	96.7	32.1	75.1	45.7
45	43.8	41.4	15.4	86.9	20.4	86.6	96.1	16.4	98.0	32.9	76.4	46.2
46	45.0	42.1	16.7	87.4	21.7	87.3	97.5	16.9	99.3	33.7	77.7	46.7
47	46.3	42.9	18.1	87.9	23.0	88.1	98.8	17.4	4300.6	34.5	79.1	47.2
48	47.6	43.6	19.4	88.4	24.3	88.9	6800.2	17.9	01.9	35.2	80.4	47.7
49	48.8	44.4	20.8	88.9	25.5	89.6	01.5	18.4	03.2	36.0	81.7	48.2
50	4150.1	1345.1	6722.1	1089.4	4226.8	1390.4	6802.8	1118.9	4304.5	1436.8	6883.1	1148.7
51	51.4	45.9	23.5	89.9	28.1	91.1	04.2	19.4	05.9	37.6	84.4	49.2
52	52.7	46.6	24.8	90.4	29.4	91.9	05.5	19.9	07.2	38.4	85.7	49.7
53	53.9	47.4	26.9	90.8	30.7	92.7	06.3	20.4	08.5	39.2	87.1	50.2
54	55.2	48.1	27.5	91.3	32.0	93.5	07.5	20.9	09.8	39.9	88.4	50.7
55	56.5	48.8	28.9	91.8	33.3	94.2	08.6	21.4	11.1	40.7	89.7	51.2
56	57.7	49.6	30.2	92.3	34.6	95.0	10.9	21.9	12.4	41.5	91.1	51.7
57	59.0	50.3	31.6	92.8	35.9	95.7	12.2	22.3	13.7	42.3	92.5	52.2
58	60.3	51.1	32.9	93.3	37.1	96.5	13.6	22.8	15.0	43.1	93.7	52.7
59	61.6	51.8	34.3	93.8	38.4	97.3	14.9	23.3	16.3	43.9	95.0	53.2



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

43

74°				75°				76°				/
T	E	C	M	T	E	C	M	T	E	C	M	
43176	14446	68964	1153.7	43965	14924	6976.0	1184.0	44765	15414	7055.0	1245.6	0
189	45.4	977	54.3	978	93.2	77.3	84.5	778	42.2	56.4	15.1	1
202	46.2	99.0	54.8	992	94.0	78.6	85.0	792	43.0	57.7	15.7	2
215	47.0	6900.4	55.3	4400.5	94.8	79.9	85.5	805	43.9	59.0	16.2	3
228	47.8	01.7	55.8	01.8	95.6	81.3	86.0	819	44.7	60.3	16.7	4
241	48.6	03.0	56.3	03.1	96.4	82.6	86.6	832	45.5	61.6	17.2	5
254	49.4	04.4	56.8	04.5	97.3	83.9	87.1	846	46.3	62.9	17.7	6
268	50.2	05.7	57.3	05.8	98.1	85.2	87.6	859	47.2	64.2	18.2	7
281	50.9	07.0	57.8	07.1	98.9	86.6	88.1	872	48.0	65.6	18.7	8
294	51.7	08.4	58.3	08.4	99.7	87.9	88.6	886	48.8	66.9	19.2	9
43307	1452.5	6909.7	1158.9	4409.8	1500.5	6989.2	1189.1	4489.9	1549.7	7068.2	1219.8	10
32.0	52.3	11.0	59.3	11.1	01.3	90.5	92.6	91.3	50.5	69.5	20.3	11
333	53.1	12.3	59.8	12.4	02.1	91.8	90.1	92.6	51.3	70.8	20.8	12
346	54.9	13.7	60.3	13.8	02.9	93.2	90.6	94.0	52.1	72.1	21.3	13
359	55.7	15.0	60.8	15.1	03.7	94.5	91.1	95.3	53.0	73.4	21.8	14
372	56.5	16.3	61.3	16.4	04.5	95.8	91.6	96.7	53.8	74.7	22.3	15
385	57.3	17.7	61.8	17.7	05.4	97.1	92.1	98.0	54.6	76.0	22.8	16
399	58.1	19.0	62.3	19.1	06.2	98.4	92.7	99.4	55.5	77.4	23.4	17
412	58.9	20.3	62.8	20.4	07.0	99.8	93.2	4500.7	56.3	78.7	23.9	18
425	59.6	21.6	63.3	21.7	07.8	7001.1	93.7	02.0	57.1	80.0	24.4	19
4343.8	1460.4	6923.0	1163.8	4423.1	1508.6	7002.4	1194.2	4503.4	1558.0	7081.3	1224.9	20
45.1	61.2	24.3	64.3	24.4	08.4	03.7	94.7	04.7	58.8	82.6	25.4	21
464	62.0	25.6	64.8	25.7	10.2	05.0	95.2	06.1	59.6	83.9	25.9	22
477	62.8	27.0	65.3	27.0	11.0	06.4	95.7	07.4	60.5	85.2	26.4	23
490	63.6	28.3	65.8	28.4	11.9	07.7	96.2	08.8	61.3	86.5	27.0	24
504	64.4	29.6	66.3	29.7	12.7	09.0	96.7	10.1	62.1	87.8	27.5	25
517	65.2	30.9	66.8	31.0	13.5	10.3	97.2	11.5	63.0	89.1	28.0	26
530	66.0	32.3	67.3	32.4	14.3	11.6	97.7	12.8	63.8	90.5	28.5	27
543	66.8	33.6	67.8	33.7	15.1	12.9	98.3	14.2	64.6	91.8	29.0	28
556	67.6	34.9	68.3	35.0	15.9	14.3	98.8	15.5	65.5	93.1	29.5	29
4356.9	1468.4	6936.2	1168.8	4436.4	1516.7	7015.6	1199.3	4516.9	1566.3	7094.4	1230.1	30
582	69.2	37.6	69.3	37.7	17.6	16.9	99.8	18.2	67.2	95.7	30.6	31
596	70.0	38.9	69.8	39.0	18.4	18.2	1200.3	19.6	68.0	97.0	31.1	32
609	70.8	40.2	70.4	40.4	19.2	19.5	00.8	20.9	68.8	98.3	31.6	33
622	71.6	41.6	70.9	41.7	20.0	20.9	01.3	22.3	69.7	99.6	32.1	34
635	72.4	42.9	71.4	43.0	20.8	22.2	01.8	23.7	70.5	7100.9	32.6	35
648	73.2	44.2	71.9	44.4	21.6	23.5	02.3	25.0	71.3	02.2	33.2	36
661	74.0	45.5	72.4	45.7	22.5	24.8	02.8	26.4	72.2	03.5	33.7	37
675	74.8	46.9	72.9	47.0	23.3	26.1	03.4	27.7	73.0	04.8	34.2	38
688	75.6	48.2	73.4	48.4	24.1	27.4	03.9	29.1	73.9	06.2	34.7	39
4370.1	1476.4	6949.5	1173.9	4449.7	1524.9	7028.8	1204.4	4530.4	1574.7	7107.5	1235.2	40
714	77.2	50.8	74.4	51.1	25.7	30.1	04.9	31.8	75.5	08.8	35.7	41
727	78.0	52.2	74.9	52.4	26.6	31.4	05.4	33.1	76.4	10.1	36.3	42
740	78.8	53.5	75.4	53.7	27.4	32.7	05.9	34.5	77.2	11.4	36.8	43
754	79.6	54.8	75.9	55.1	28.2	34.0	06.4	35.8	78.1	12.7	37.3	44
767	80.4	56.1	76.4	56.4	29.0	35.3	06.9	37.2	78.9	14.0	37.8	45
780	81.2	57.5	76.9	57.7	29.8	36.6	07.4	38.6	79.7	15.3	38.3	46
793	82.0	58.8	77.4	59.1	30.7	38.0	08.0	39.9	80.6	16.6	38.8	47
806	82.8	60.1	77.9	60.4	31.5	39.3	08.5	41.3	81.4	17.9	39.4	48
820	83.6	61.4	78.4	61.7	32.3	40.6	09.0	42.6	82.3	19.2	39.9	49
4383.3	1484.4	6962.8	1178.9	4463.1	1533.1	7041.9	1209.5	4544.0	1583.1	7120.5	1240.4	50
846	85.2	64.1	79.4	64.4	34.0	43.2	10.0	45.3	84.0	21.8	40.9	51
859	86.0	65.4	80.0	65.8	34.8	44.5	10.5	46.7	84.8	23.1	41.4	52
873	86.8	66.7	80.5	67.1	35.6	45.8	11.0	48.1	85.7	24.4	41.9	53
886	87.6	68.0	81.0	68.4	36.4	47.2	11.5	49.4	86.5	25.8	42.5	54
899	88.4	69.4	81.5	69.8	37.3	48.5	12.1	50.8	87.3	27.1	43.0	55
912	89.2	70.7	82.0	71.1	38.1	49.8	12.6	52.1	88.2	28.4	43.5	56
925	90.0	72.0	82.5	72.5	38.9	51.1	13.1	53.5	89.0	29.7	44.0	57
939	90.8	73.3	83.0	73.8	39.7	52.4	13.6	54.8	89.9	31.0	44.5	58
952	91.6	74.7	83.5	75.2	40.6	53.7	14.1	56.2	90.7	32.3	45.1	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	77°				78°				79°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	45576	5916	71336	12456	46398	16430	72116	12769	47232	16958	72890	13085
1	589	924	34.9	461	412	439	129	774	24.6	96.7	90.3	09.0
2	603	933	34.2	466	425	448	142	779	26.0	976	916	09.6
3	617	941	37.5	471	439	456	155	784	27.4	985	929	10.1
4	630	950	38.8	477	453	465	167	790	28.8	994	942	10.6
5	644	958	40.1	482	467	474	180	795	30.2	1700.2	954	11.2
6	657	967	41.4	487	481	482	193	800	31.6	01.1	967	11.7
7	671	975	42.7	492	494	491	206	805	33.0	02.0	980	12.2
8	685	984	44.0	497	508	500	219	811	34.4	02.9	993	12.8
9	698	992	45.3	503	522	509	232	816	35.8	03.8	1300.6	13.3
10	45712	1600.1	71466	1250.8	46536	1651.7	7224.5	1282.1	47372	1704.7	7301.9	1313.8
11	726	009	47.9	513	550	526	258	826	38.6	05.6	03.1	14.3
12	739	018	49.2	518	564	535	271	832	40.0	06.5	04.4	14.9
13	753	026	50.5	523	577	543	284	837	41.4	07.4	05.7	15.4
14	766	035	51.8	529	591	552	297	842	42.8	08.3	07.0	15.9
15	780	043	53.1	534	605	561	310	848	44.2	09.2	08.3	16.5
16	794	052	54.4	539	619	570	323	853	45.6	10.1	09.6	17.0
17	807	060	55.7	544	633	578	336	858	47.0	11.0	10.9	17.5
18	821	069	57.0	549	647	587	349	863	48.4	11.9	12.1	18.1
19	835	077	58.3	555	661	596	362	869	49.8	12.8	13.4	18.6
20	45848	1608.6	71596	1256.0	46674	1660.5	72374	12874	47512	1713.7	7314.7	1319.1
21	86.2	084	60.9	565	688	613	387	879	52.6	14.6	16.0	19.7
22	876	10.3	62.2	570	702	622	400	884	54.0	15.5	17.3	20.2
23	889	11.1	63.5	575	716	631	413	890	55.4	16.4	18.6	20.7
24	903	12.0	64.8	581	730	640	426	895	56.8	17.3	19.8	21.3
25	917	12.9	66.1	586	744	649	439	900	58.3	18.2	21.1	21.8
26	931	13.7	67.4	591	758	657	452	905	59.7	19.1	22.4	22.3
27	944	14.6	68.7	596	772	666	465	911	61.1	20.0	23.7	22.9
28	958	15.4	70.0	60.1	785	675	478	916	62.5	20.9	25.0	23.4
29	972	16.3	71.3	60.7	799	684	49.1	92.1	63.9	21.8	26.2	23.9
30	45985	1617.1	71726	1261.2	46813	1669.2	72504	1292.7	47653	1722.7	7327.5	1324.5
31	99.9	18.0	73.9	61.7	827	70.1	51.7	93.2	66.7	23.6	28.8	25.0
32	4601.3	18.9	75.2	62.2	841	71.0	52.9	93.7	68.1	24.5	30.1	25.5
33	02.6	19.7	76.5	62.8	855	71.9	54.2	94.2	69.5	25.4	31.4	26.1
34	04.0	20.6	77.8	63.3	869	72.8	55.5	94.8	70.9	26.3	32.6	26.6
35	05.4	21.4	79.1	63.8	883	73.6	56.8	95.3	72.4	27.2	33.9	27.1
36	06.8	22.3	80.4	64.3	897	74.5	58.1	95.8	73.8	28.1	35.2	27.7
37	08.1	23.2	81.7	64.8	911	75.4	59.4	96.3	75.2	29.0	36.5	28.2
38	09.5	24.0	83.0	65.4	924	76.3	60.7	96.9	76.6	29.9	37.8	28.7
39	10.9	24.9	84.3	65.9	938	77.2	62.0	97.4	78.0	30.8	39.1	29.3
40	46122	1625.7	71856	1266.4	46952	1678.1	72633	12979	47794	1731.7	73403	1329.8
41	13.6	26.6	86.9	66.9	966	78.9	64.5	98.5	80.8	32.6	41.6	30.3
42	15.0	27.5	88.2	67.5	980	79.8	65.8	99.0	82.2	33.5	42.9	30.9
43	16.4	28.3	89.5	68.0	994	80.7	67.1	99.5	83.7	34.4	44.2	31.4
44	17.7	29.2	90.8	68.5	4700.8	81.6	68.4	1300.0	85.1	35.3	45.4	31.9
45	19.1	30.0	92.1	69.0	02.2	82.5	69.7	00.6	86.5	36.2	46.7	32.5
46	20.5	30.9	93.4	69.5	03.6	83.4	71.0	01.1	87.9	37.1	48.0	33.0
47	21.9	31.8	94.7	70.1	05.0	84.2	72.3	01.6	89.3	38.0	49.3	33.5
48	23.2	32.6	96.0	70.6	06.4	85.1	73.6	02.2	90.7	38.9	50.6	34.1
49	24.6	33.5	97.3	71.1	07.8	86.0	74.9	02.7	92.1	39.9	51.8	34.6
50	46260	1634.4	71986	1271.6	47092	1686.9	7276.1	1303.2	47936	1740.8	7353.1	1335.1
51	274	35.2	99.9	72.2	106	87.8	77.4	03.7	95.0	41.7	54.4	35.7
52	28.8	36.1	1201.2	72.7	120	88.7	78.7	04.3	96.4	42.6	55.7	36.2
53	30.1	37.0	02.5	73.2	134	89.6	80.0	04.8	97.8	43.5	57.0	36.7
54	31.5	37.8	03.8	73.7	148	90.5	81.3	05.3	99.2	44.4	58.2	37.3
55	32.9	38.7	05.1	74.3	162	91.3	82.6	05.9	4300.7	45.3	59.5	37.8
56	34.3	39.6	06.4	74.8	176	92.2	83.9	06.4	02.1	46.2	60.8	38.3
57	35.6	40.4	07.7	75.3	190	93.1	85.2	06.9	03.5	47.1	62.1	38.9
58	37.0	41.3	09.0	75.8	204	94.0	86.4	07.4	04.9	48.1	63.3	39.4
59	38.4	42.2	10.3	76.4	218	94.9	87.7	08.0	06.3	49.0	64.6	39.9

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

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80°				81°				82°				/
T	E	C	M	T	E	C	M	T	E	C	M	
4807.7	1749.9	7365.9	1340.5	4893.6	1805.3	7442.2	1372.8	4980.7	1862.2	7518.0	1405.4	0
09.2	50.8	67.2	41.0	95.0	06.3	435	73.3	82.2	63.2	19.2	06.0	1
10.6	51.7	68.5	41.6	96.5	07.2	448	73.9	83.6	64.1	20.5	06.5	2
12.0	52.6	69.7	42.1	97.9	08.1	460	74.4	85.1	65.1	21.8	07.1	3
13.4	53.5	71.0	42.6	99.4	09.1	473	75.0	86.6	66.1	23.0	07.6	4
14.9	54.4	72.3	43.2	4900.8	10.0	486	75.5	88.0	67.0	24.3	08.2	5
16.3	55.4	73.6	43.7	02.2	11.0	498	76.0	89.5	68.0	25.5	08.7	6
17.7	56.3	74.8	44.2	03.7	11.9	51.1	76.6	91.0	68.9	26.8	09.3	7
19.1	57.2	76.1	44.8	05.1	12.8	52.4	77.1	92.4	69.9	28.0	09.8	8
20.5	58.1	77.4	45.3	06.6	13.8	53.6	77.7	93.9	70.9	29.3	10.4	9
4822.0	1759.0	7378.7	1345.8	4908.0	1814.7	7454.9	1378.2	4995.4	1871.8	7530.5	1410.9	10
23.4	59.9	79.9	46.4	09.5	15.7	56.2	78.7	96.8	72.8	31.8	11.4	11
24.8	60.9	81.2	46.9	10.9	16.6	57.4	79.3	98.3	73.8	33.1	12.0	12
26.2	61.8	82.5	47.5	12.4	17.5	58.7	79.8	99.8	74.7	34.3	12.5	13
27.7	62.7	83.8	48.0	13.8	18.5	60.0	80.4	5001.2	75.7	35.6	13.1	14
29.1	63.6	85.0	48.5	15.2	19.4	61.2	80.9	02.7	76.7	36.8	13.6	15
30.5	64.5	86.3	49.1	16.7	20.4	62.5	81.5	04.2	77.6	38.1	14.2	16
31.9	65.4	87.6	49.6	18.1	21.3	63.7	82.0	05.6	78.6	39.5	14.7	17
33.4	66.4	88.9	50.1	19.6	22.3	65.0	82.5	07.1	79.6	40.6	15.3	18
34.8	67.3	90.1	50.7	21.0	23.2	66.3	83.1	08.6	80.5	41.8	15.8	19
4836.2	1768.2	7391.4	1351.2	4922.5	1824.1	7467.5	1383.6	5010.0	1881.5	7543.1	1416.4	20
37.6	69.1	92.7	51.8	23.9	25.1	68.8	84.2	11.5	82.5	44.4	16.9	21
39.1	70.1	93.9	52.3	25.4	26.0	70.1	84.7	13.0	83.4	45.6	17.5	22
40.5	71.0	95.2	52.8	26.8	27.0	71.3	85.3	14.5	84.4	46.9	18.0	23
41.9	71.9	96.5	53.4	28.3	27.9	72.6	85.8	15.9	85.4	48.1	18.6	24
43.4	72.8	97.8	53.9	29.7	28.9	73.9	86.3	17.4	86.3	49.4	19.1	25
44.8	73.7	99.0	54.4	31.2	29.8	75.1	86.9	18.9	87.3	50.6	19.7	26
46.2	74.7	7400.3	55.0	32.6	30.8	76.4	87.4	20.3	88.3	51.9	20.2	27
47.6	75.6	01.6	55.5	34.1	31.7	77.6	88.0	21.8	89.2	53.1	20.8	28
49.1	76.5	02.9	56.1	35.5	32.6	78.9	88.5	23.3	90.2	54.4	21.3	29
4850.5	1777.4	7404.1	1356.6	4937.0	1833.6	7480.2	1389.1	5024.8	1891.2	7555.6	1421.9	30
51.9	78.4	05.4	57.1	38.4	34.5	81.4	89.6	26.2	92.2	56.9	22.4	31
53.4	79.3	06.7	57.7	39.9	35.5	82.7	90.2	27.7	93.1	58.1	23.0	32
54.8	80.2	07.9	58.2	41.3	36.4	84.0	90.7	29.2	94.1	59.4	23.5	33
56.2	81.1	09.2	58.7	42.8	37.4	85.2	91.2	30.7	95.1	60.7	24.1	34
57.7	82.1	10.5	59.3	44.2	38.3	86.5	91.8	32.1	96.1	61.9	24.6	35
59.1	83.0	11.8	59.8	45.7	39.3	87.7	92.3	33.6	97.0	63.2	25.2	36
60.5	83.9	13.0	60.4	47.2	40.2	89.0	92.9	35.1	98.0	64.4	25.7	37
62.0	84.8	14.3	60.9	48.6	41.2	90.3	93.4	36.6	99.0	65.7	26.3	38
63.4	85.8	15.6	61.4	50.1	42.1	91.5	94.0	38.1	100.0	66.9	26.8	39
4864.8	1786.7	7416.8	1362.0	4951.5	1843.1	7492.8	1394.5	5039.5	1900.9	7568.2	1427.4	40
66.3	87.6	18.1	62.5	53.0	44.0	94.1	95.1	41.0	01.9	69.4	27.9	41
67.7	88.6	19.4	63.1	54.4	45.0	95.3	95.6	42.5	02.9	70.7	28.5	42
69.1	89.5	20.7	63.6	55.9	46.0	96.6	96.1	44.0	03.9	71.9	29.0	43
70.6	90.4	21.9	64.1	57.3	46.9	97.8	96.7	45.4	04.8	73.2	29.6	44
72.0	91.3	23.2	64.7	58.8	47.9	99.1	97.2	46.9	05.8	74.4	30.1	45
73.4	92.3	24.5	65.3	60.3	48.8	2500.4	97.8	48.4	06.8	75.7	30.7	46
74.9	93.2	25.7	65.8	61.7	49.8	01.6	98.5	49.9	07.8	76.9	31.3	47
76.3	94.1	27.0	66.3	63.2	50.7	02.9	99.9	51.4	08.7	78.2	31.8	48
77.8	95.1	28.3	66.8	64.6	51.7	04.1	99.4	52.8	09.7	79.4	32.3	49
4879.2	1796.0	7429.5	1367.4	4966.1	1852.6	7505.4	1400.0	5054.3	1910.7	7580.7	1432.9	50
80.6	96.9	30.8	67.9	67.6	53.6	06.6	00.5	55.8	11.7	81.9	33.4	51
82.1	97.9	32.1	68.5	69.0	54.5	07.9	01.1	57.3	12.7	83.2	34.0	52
83.5	98.8	33.3	69.0	70.5	55.5	09.2	01.6	58.8	13.7	84.4	34.5	53
84.9	99.7	34.6	69.5	71.9	56.5	10.4	02.1	60.3	14.6	85.7	35.1	54
86.4	100.7	35.9	70.1	73.4	57.4	11.7	02.7	61.7	15.6	86.9	35.6	55
87.8	01.6	37.1	70.6	74.9	58.4	12.9	03.2	63.2	16.6	88.2	36.2	56
89.3	02.5	38.4	71.2	76.3	59.3	14.2	03.8	64.7	17.6	89.4	36.7	57
90.7	03.5	39.7	71.7	77.8	60.3	15.5	04.3	66.2	18.6	90.7	37.3	58
92.1	04.4	41.0	72.2	79.2	61.3	16.7	04.9	67.7	19.6	91.9	37.8	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	83°				84°				85°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	5069.2	1920.5	7592.2	1438.4	5159.0	1980.4	7662.8	1471.7	5250.3	2041.7	7741.8	1505.3
1	70.7	21.5	94.4	38.9	60.5	81.4	69.0	72.2	51.8	42.7	43.0	05.9
2	72.1	22.5	95.7	39.5	62.0	82.4	70.2	72.8	53.3	43.8	44.2	06.4
3	73.6	23.5	96.9	40.1	63.5	83.4	71.5	73.4	54.9	44.8	45.5	07.0
4	75.1	24.5	98.2	40.6	65.0	84.4	72.7	73.9	56.4	45.9	46.7	07.6
5	76.6	25.5	99.4	41.2	66.6	85.4	74.0	74.5	57.9	46.9	47.9	08.1
6	78.1	26.4	7600.6	41.7	68.1	86.4	75.2	75.0	59.5	47.9	49.2	08.7
7	79.6	27.4	01.9	42.3	69.6	87.4	76.4	75.6	61.0	49.0	50.4	09.3
8	81.1	28.4	03.1	42.8	71.1	88.4	77.7	76.2	62.5	50.0	51.6	09.8
9	82.6	29.4	04.4	43.4	72.6	89.5	78.9	76.7	64.1	51.1	52.8	10.4
10	5084.0	1930.4	7605.6	1443.9	5174.1	1990.5	7680.1	1477.3	5265.6	2052.1	7754.1	1510.9
11	85.5	31.4	06.9	44.5	75.6	91.5	81.4	77.8	67.1	53.1	55.3	11.5
12	87.0	32.4	08.1	45.0	77.1	92.5	82.6	78.4	68.7	54.2	56.5	12.1
13	88.5	33.4	09.4	45.6	78.7	93.5	83.9	78.9	70.2	55.2	57.8	12.6
14	90.0	34.4	10.6	46.1	80.2	94.5	85.1	79.5	71.8	56.3	59.0	13.2
15	91.5	35.4	11.9	46.7	81.7	95.5	86.3	80.1	73.3	57.3	60.2	13.8
16	93.0	36.3	13.1	47.2	83.2	96.6	87.6	80.6	74.8	58.3	61.4	14.3
17	94.5	37.3	14.4	47.8	84.7	97.6	88.8	81.2	76.4	59.4	62.7	14.9
18	96.0	38.3	15.6	48.4	86.2	98.6	90.0	81.7	77.9	60.4	63.9	15.5
19	97.5	39.3	16.9	48.9	87.7	99.6	91.3	82.3	79.5	61.5	65.1	16.0
20	5099.0	1940.3	7618.1	1449.5	5189.3	2000.6	7692.5	1482.9	5281.0	2062.5	7766.3	1516.6
21	5100.4	41.3	19.3	50.0	90.8	01.7	93.7	83.4	82.5	63.6	67.6	17.2
22	01.9	42.3	20.6	50.6	92.3	02.7	95.0	84.0	84.1	64.6	68.8	17.7
23	03.4	43.3	21.8	51.1	93.8	03.7	96.2	84.5	85.6	65.7	70.0	18.3
24	04.9	44.3	23.1	51.7	95.3	04.7	97.4	85.1	87.2	66.7	71.2	18.8
25	06.4	45.3	24.3	52.2	96.8	05.7	98.7	85.7	88.7	67.7	72.5	19.4
26	07.9	46.3	25.6	52.8	98.4	06.8	99.9	86.2	90.3	68.8	73.7	20.0
27	09.4	47.3	26.8	53.3	99.9	07.8	7701.2	86.8	91.8	69.8	74.9	20.5
28	10.9	48.3	28.1	53.9	5201.4	08.8	02.4	87.3	93.3	70.9	76.1	21.1
29	12.4	48.3	29.3	54.4	02.9	09.8	03.6	87.9	94.9	71.9	77.4	21.7
30	5113.9	1950.3	7630.5	1455.0	5204.4	2010.8	7704.9	1488.5	5296.4	2073.0	7778.6	1522.2
31	15.4	51.2	31.8	55.6	06.0	11.9	06.1	89.0	98.0	74.0	79.8	22.8
32	16.9	52.2	33.0	56.1	07.5	12.9	07.3	89.6	99.5	75.1	81.0	23.4
33	18.4	53.2	34.3	56.7	09.0	13.9	08.6	90.1	5301.1	76.1	82.3	23.9
34	19.9	54.2	35.5	57.2	10.5	14.9	09.8	90.7	02.6	77.2	83.5	24.5
35	21.4	55.2	36.8	57.9	12.1	16.0	11.0	91.3	04.2	78.2	84.7	25.1
36	22.9	56.2	38.0	58.3	13.6	17.0	12.3	91.8	05.7	79.3	85.9	25.6
37	24.4	57.2	39.2	58.9	15.1	18.0	13.5	92.4	07.3	80.3	87.1	26.2
38	25.9	58.2	40.5	59.4	16.6	19.0	14.7	92.9	08.8	81.4	88.4	26.8
39	27.4	59.2	41.7	60.0	18.2	20.1	15.9	93.5	10.4	82.4	89.6	27.3
40	5128.9	1960.2	7643.0	1460.6	5219.7	2021.1	7717.2	1494.1	5311.9	2083.5	7790.8	1527.9
41	30.4	61.2	44.2	61.1	21.2	22.1	18.4	94.6	13.5	84.6	92.0	28.5
42	31.9	62.2	45.4	61.7	22.7	23.1	19.6	95.2	15.0	85.6	93.3	29.0
43	33.4	63.2	46.7	62.2	24.3	24.2	20.9	95.8	16.6	86.7	94.5	29.6
44	34.9	64.2	47.9	62.8	25.8	25.2	22.1	96.3	18.1	87.7	95.7	30.2
45	36.4	65.3	49.2	63.3	27.3	26.2	23.3	96.9	19.7	88.8	96.9	30.7
46	37.9	66.3	50.4	63.9	28.8	27.3	24.6	97.4	21.2	89.8	98.1	31.3
47	39.4	67.3	51.7	64.4	30.4	28.3	25.8	98.0	22.8	90.9	99.4	31.9
48	40.9	68.3	52.9	65.0	31.9	29.3	27.0	98.6	24.3	91.9	7800.6	32.4
49	42.4	69.3	54.1	65.6	33.4	30.3	28.3	99.1	25.9	93.0	01.8	33.0
50	5143.9	1970.3	7655.4	1466.1	5234.9	2031.4	7729.5	1499.7	5327.4	2094.1	7803.0	1533.6
51	45.4	71.3	56.6	66.7	36.5	32.4	30.7	1500.2	29.0	95.1	04.2	34.1
52	46.9	72.3	57.9	67.2	38.0	33.4	32.0	00.8	30.5	96.2	05.5	34.7
53	48.4	73.3	59.1	67.8	39.5	34.5	33.2	01.4	32.1	97.2	06.7	35.3
54	50.0	74.3	60.3	68.3	41.1	35.5	34.4	01.9	33.6	98.3	07.9	35.8
55	51.5	75.3	61.6	68.9	42.6	36.5	35.6	02.5	35.2	99.4	09.1	36.4
56	53.0	76.3	62.8	69.5	44.1	37.6	36.9	03.1	36.8	2100.4	10.3	37.0
57	54.5	77.3	64.1	70.0	45.7	38.6	38.1	03.6	38.3	01.5	11.6	37.5
58	56.0	78.3	65.3	70.6	47.2	39.6	39.3	04.2	39.9	02.5	12.8	38.1
59	57.5	79.3	66.5	71.1	48.7	40.7	40.6	04.7	41.4	03.6	14.0	38.7

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

47

86°				87°				88°				I
T	E	C	M	T	E	C	M	T	E	C	M	
5343.2	2104.7	7815.2	5392.2	5437.2	2169.2	7888.1	5473.5	5533.1	22355	7960.3	1608.1	0
44.5	05.7	16.4	39.8	38.8	70.3	89.3	74.1	34.7	36.6	61.5	08.7	1
146.1	06.8	17.7	40.4	40.4	71.4	90.5	75.7	36.3	37.7	62.7	09.2	2
47.7	07.8	18.9	41.0	42.0	72.5	91.7	75.2	37.9	38.9	63.9	09.8	3
49.2	08.9	20.1	41.5	43.6	73.6	92.9	75.8	39.5	40.0	65.1	10.4	4
50.8	10.0	21.3	42.1	45.2	74.7	94.1	76.4	41.1	41.1	66.3	11.0	5
52.3	11.0	22.5	42.7	46.7	75.8	95.3	77.0	42.7	42.2	67.5	11.6	6
53.9	12.1	23.8	43.2	48.3	76.9	96.5	77.5	44.3	43.3	68.7	12.1	7
55.5	13.2	25.0	43.8	49.9	78.0	97.7	78.1	46.0	44.5	69.9	12.7	8
57.0	14.2	26.2	44.4	51.5	79.1	98.9	78.7	47.6	45.6	71.1	13.3	9
5358.6	2115.3	7827.4	5449.9	5453.1	2180.2	7900.1	5479.3	5549.2	2246.7	7972.3	1613.9	10
60.1	16.4	28.6	45.5	54.7	81.3	01.4	79.8	50.8	47.8	73.5	14.5	11
61.7	17.4	29.8	46.1	56.3	82.4	02.6	80.4	52.4	49.0	74.7	15.0	12
63.3	18.5	31.1	46.6	57.9	83.4	03.8	81.0	54.0	50.1	75.9	15.6	13
64.8	19.6	32.3	47.2	59.5	84.5	05.0	81.5	55.7	51.2	77.1	16.2	14
66.4	20.6	33.5	47.8	61.0	85.6	06.2	82.1	57.3	52.3	78.3	16.8	15
68.0	21.7	34.7	48.4	62.6	86.7	07.4	82.7	58.9	53.5	79.5	17.4	16
69.5	22.8	35.9	48.9	64.2	87.8	08.6	83.3	60.5	54.6	80.7	17.9	17
71.1	23.9	37.1	49.5	65.8	88.9	09.8	83.8	62.1	55.7	81.9	18.5	18
72.7	24.9	38.4	50.1	67.4	90.0	11.0	84.4	63.7	56.8	83.0	19.1	19
5374.2	2126.0	7839.6	5506.6	5469.0	2191.1	7912.2	5485.0	5565.4	2258.0	7984.2	1619.7	20
75.8	27.1	40.8	51.2	70.6	92.2	13.4	85.6	67.0	59.1	85.4	20.3	21
77.4	28.1	42.0	51.8	72.2	93.3	14.6	86.1	68.6	60.2	86.6	20.8	22
78.9	29.2	43.2	52.3	73.8	94.4	15.8	86.7	70.2	61.4	87.8	21.4	23
80.5	30.3	44.4	52.9	75.4	95.5	17.0	87.3	71.8	62.5	89.0	22.0	24
82.1	31.4	45.6	53.5	77.0	96.6	18.2	87.9	73.5	63.6	90.2	22.6	25
83.6	32.4	46.9	54.1	78.6	97.7	19.4	88.4	75.1	64.8	91.4	23.2	26
85.2	33.5	48.1	54.6	80.2	98.8	20.6	89.0	76.7	65.9	92.6	23.7	27
86.8	34.6	49.3	55.2	81.8	99.9	21.8	89.6	78.3	67.0	93.8	24.3	28
88.3	35.7	50.5	55.8	83.4	101.1	23.1	90.2	80.0	68.1	95.0	24.9	29
5389.9	2136.7	7851.7	5563.3	5484.9	2202.2	7924.3	5490.8	5581.6	2269.3	7996.2	1625.5	30
91.5	37.8	52.9	56.9	86.5	03.3	25.5	91.3	83.2	70.4	97.4	26.1	31
93.1	38.9	54.1	57.5	88.1	04.4	26.7	91.9	84.8	71.5	98.6	26.7	32
94.6	40.0	55.4	58.1	89.7	05.5	27.9	92.5	86.5	72.7	99.8	27.3	33
96.2	41.0	56.6	58.6	91.3	06.6	29.1	93.1	88.1	73.8	8001.0	27.8	34
97.8	42.1	57.8	59.2	92.9	07.7	30.3	93.6	89.7	75.0	02.2	28.4	35
99.3	43.2	59.0	59.8	94.5	08.8	31.5	94.2	91.3	76.1	03.4	29.0	36
5400.9	44.3	60.2	60.3	96.1	09.9	32.7	94.8	93.0	77.2	04.5	29.6	37
02.5	45.4	61.4	60.9	97.7	11.0	33.9	95.4	94.6	78.4	05.7	30.1	38
04.1	46.4	62.6	61.5	99.3	12.1	35.1	95.9	96.2	79.5	06.9	30.7	39
5405.6	2147.5	7863.8	5562.1	5500.9	2213.2	7936.3	5496.5	5597.8	2280.6	8008.1	1631.3	40
07.2	48.6	65.1	62.6	02.5	14.3	37.5	97.1	99.5	81.8	09.3	31.9	41
08.8	49.7	66.3	63.2	04.1	15.4	38.7	97.7	5601.1	82.9	10.5	32.5	42
10.4	50.8	67.5	63.8	05.7	16.5	39.9	98.3	02.7	84.1	11.7	33.1	43
12.0	51.9	68.7	64.3	07.3	17.7	41.1	98.8	04.4	85.2	12.9	33.6	44
13.5	52.9	69.9	64.9	09.0	18.8	42.3	99.4	06.0	86.3	14.1	34.2	45
15.1	54.0	71.1	65.5	10.6	19.9	43.5	16000.0	07.5	87.5	15.3	34.8	46
16.7	55.1	72.3	66.1	12.2	21.0	44.7	00.6	09.3	88.6	16.5	35.4	47
18.3	56.2	73.5	66.6	13.8	22.1	45.9	01.1	10.9	89.8	17.7	36.0	48
19.8	57.3	74.8	67.2	15.4	23.2	47.1	01.7	12.5	90.9	18.8	36.6	49
5421.4	2158.4	7876.0	5572.8	5517.0	2224.3	7948.3	1602.3	5614.2	2292.0	8020.0	1637.1	50
23.0	59.4	77.2	68.3	18.6	25.5	49.5	02.9	15.8	93.2	21.2	37.7	51
24.6	60.5	78.4	68.9	20.2	26.6	50.7	03.5	17.4	94.3	22.4	38.3	52
26.2	61.6	79.6	69.5	21.8	27.7	51.9	04.0	19.1	95.5	23.6	38.9	53
27.7	62.7	80.8	70.1	23.4	28.8	53.1	04.6	20.7	96.6	24.8	39.5	54
29.3	63.8	82.0	70.6	25.0	29.9	54.3	05.2	22.3	97.8	26.0	40.1	55
30.9	64.9	83.2	71.2	26.6	31.0	55.5	05.8	24.0	98.9	27.2	40.6	56
32.5	66.0	84.4	71.8	28.2	32.1	56.7	06.3	25.6	2300.1	28.4	41.2	57
34.1	67.1	85.6	72.4	29.8	33.3	57.9	06.9	27.2	01.2	29.6	41.8	58
35.7	68.1	86.9	72.9	31.4	34.4	59.1	07.5	28.9	02.4	30.7	42.4	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	89°				90°				91°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	5630.5	2303.5	8031.9	1643.0	5729.7	2373.3	8102.9	1678.2	5890.5	2444.9	8173.4	1737.7
1	32.2	04.7	33.1	43.6	31.3	74.5	04.1	78.8	32.2	46.2	74.5	16.3
2	33.8	05.8	34.3	44.1	33.0	75.7	05.3	79.4	33.9	47.4	75.7	14.9
3	35.4	06.9	35.5	44.7	34.7	76.8	06.5	79.9	35.6	48.6	76.9	15.5
4	37.1	08.1	36.7	45.3	36.3	78.0	07.7	80.5	37.3	49.8	78.0	16.1
5	38.7	09.2	37.9	45.9	38.0	79.2	08.8	81.1	39.0	51.0	79.2	16.7
6	40.3	10.4	39.1	46.5	39.7	80.4	10.0	81.7	40.7	52.2	80.4	17.3
7	42.0	11.6	40.2	47.1	41.3	81.6	11.2	82.3	42.4	53.4	81.5	17.9
8	43.6	12.7	41.4	47.7	43.0	82.7	12.4	82.9	44.1	54.6	82.7	18.4
9	45.3	13.9	42.6	48.2	44.7	83.9	13.5	83.5	45.8	55.9	83.9	19.0
10	5646.9	2315.0	8043.8	1648.8	5746.3	2385.1	8114.7	1684.1	5847.5	2457.1	8185.0	179.6
11	48.6	16.2	45.0	49.4	46.0	86.3	15.9	84.7	49.2	58.3	86.2	20.2
12	50.2	17.3	46.2	50.0	47.7	87.5	17.1	85.3	50.9	59.5	87.4	20.8
13	51.8	18.5	47.4	50.6	51.4	88.7	18.3	85.8	52.6	60.7	88.5	21.4
14	53.5	19.6	48.6	51.2	53.0	89.8	19.4	86.4	54.3	61.9	89.7	22.0
15	55.1	20.8	49.7	51.7	54.7	91.0	20.6	87.0	56.0	63.2	90.9	22.6
16	56.8	21.9	50.9	52.3	56.4	92.2	21.8	87.6	57.7	64.4	92.0	23.2
17	58.4	23.1	52.1	52.9	58.1	93.4	23.0	88.2	59.4	65.6	93.2	23.8
18	60.1	24.3	53.3	53.5	59.7	94.6	24.1	88.8	61.1	66.8	94.3	24.4
19	61.7	25.4	54.5	54.1	61.4	95.8	25.3	89.4	62.9	68.0	95.5	25.0
20	5663.4	2326.6	8055.7	1654.7	5763.1	2397.0	8126.5	1690.0	5864.6	2469.3	8196.7	1725.6
21	65.0	27.7	56.9	55.3	64.8	98.2	27.7	90.6	66.3	70.5	97.8	26.2
22	66.7	28.9	58.0	55.8	66.4	99.4	28.8	91.2	68.0	71.7	99.0	26.8
23	68.3	30.0	59.2	56.4	68.1	100.5	30.0	91.8	69.7	72.9	100.2	27.4
24	70.0	31.2	60.4	57.0	69.8	101.7	31.2	92.3	71.4	74.1	101.3	28.0
25	71.6	32.4	61.6	57.6	71.5	102.9	32.4	92.9	73.1	75.4	102.5	28.6
26	73.3	33.5	62.8	58.2	73.1	104.1	33.5	93.5	74.8	76.6	103.7	29.2
27	74.9	34.7	64.0	58.8	74.8	105.3	34.7	94.1	76.5	77.8	104.8	29.8
28	76.6	35.8	65.1	59.4	76.5	106.5	35.9	94.7	78.2	79.0	106.0	30.4
29	78.2	37.0	66.3	59.9	78.2	107.7	37.1	95.3	79.9	80.3	107.2	31.0
30	5679.9	2338.2	8067.5	1660.5	5779.9	2408.9	8138.2	1695.9	5881.7	2481.5	8208.3	1731.6
31	81.5	39.3	68.7	61.1	81.6	109.1	39.4	96.5	83.4	82.7	109.5	32.2
32	83.2	40.5	69.9	61.7	83.2	110.3	40.6	97.1	85.1	83.9	110.6	32.8
33	84.8	41.7	71.1	62.3	84.9	112.5	41.7	97.7	86.8	85.2	111.8	33.4
34	86.5	42.8	72.2	62.9	86.6	113.7	42.9	98.3	88.5	86.4	113.0	34.0
35	88.1	44.0	73.4	63.5	88.3	114.9	44.1	98.9	90.2	87.6	114.1	34.6
36	89.8	45.2	74.6	64.1	90.0	116.1	45.3	99.4	91.9	88.8	115.3	35.1
37	91.4	46.3	75.8	64.6	91.7	117.3	46.4	100.0	93.6	90.1	116.5	35.7
38	93.1	47.5	77.0	65.2	93.3	118.5	47.6	100.6	95.4	91.3	117.6	36.3
39	94.8	48.7	78.2	65.8	95.0	119.7	48.8	101.2	97.1	92.5	118.8	36.9
40	5696.4	2349.8	8079.3	1666.4	5796.7	2420.9	8150.0	1701.8	5898.8	2493.8	8219.9	1737.5
41	98.1	51.0	80.5	67.0	98.4	121.1	51.1	102.4	99.0	95.0	121.1	38.1
42	99.7	52.2	81.7	67.6	100.1	123.3	52.3	103.0	100.2	96.2	122.3	38.7
43	5701.4	53.3	82.9	68.2	101.8	124.5	53.5	103.6	101.9	97.5	123.4	39.3
44	101.0	54.5	84.1	68.8	103.5	125.7	54.6	104.2	103.7	98.7	124.6	39.9
45	102.7	55.7	85.3	69.3	105.1	126.9	55.8	104.8	105.4	99.9	125.7	40.5
46	104.4	56.9	86.4	69.9	106.8	128.1	56.9	105.4	107.1	250.2	126.9	41.1
47	106.0	58.0	87.6	70.5	108.5	129.3	58.0	106.0	108.8	108.8	128.1	41.7
48	107.7	59.2	88.8	71.1	110.2	130.5	59.3	106.6	110.5	109.5	129.2	42.3
49	111.3	60.4	90.0	71.7	111.9	131.7	60.5	107.2	112.3	110.3	130.4	42.9
50	5713.0	2361.5	8091.2	1672.3	5813.6	2432.9	8161.7	1707.7	5916.0	2506.1	8231.5	1743.5
51	14.7	62.7	92.3	72.9	15.3	134.1	62.8	108.3	114.7	111.7	131.7	43.5
52	16.3	63.9	93.5	73.5	17.0	135.3	64.0	108.9	116.4	112.9	132.9	44.1
53	18.0	65.1	94.7	74.1	18.7	136.5	65.2	109.5	118.1	114.1	134.1	44.7
54	19.7	66.2	95.9	74.6	20.4	137.7	66.3	110.1	119.8	115.3	135.3	45.3
55	21.3	67.4	97.1	75.2	22.1	138.9	67.5	110.7	121.5	116.5	136.5	45.9
56	23.0	68.6	98.2	75.8	23.8	140.1	68.7	111.3	123.2	117.7	137.7	46.5
57	24.7	69.8	99.4	76.4	25.4	141.3	69.8	111.9	124.9	118.9	138.9	47.1
58	26.3	70.9	100.6	77.0	27.1	142.5	71.0	112.5	126.6	120.1	140.1	47.7
59	28.0	72.1	101.8	77.6	28.8	143.7	72.2	113.1	128.3	121.3	141.3	48.3

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

92°				93°				94°				/
T	E	C	M	T	E	C	M	T	E	C	M	
5933.2	2518.5	8243.1	1749.5	6037.8	2594.0	8312.3	1785.6	6144.3	2677.6	8320.8	1822.0	0
35.0	19.7	44.3	50.1	39.6	25.3	13.4	86.2	46.1	72.9	87.9	22.6	1
36.7	21.0	45.4	50.7	41.3	26.6	14.6	86.8	47.9	74.2	83.1	23.3	2
38.4	22.2	46.6	51.3	43.1	27.9	15.7	87.4	49.7	75.6	84.2	23.9	3
40.1	23.5	47.8	51.9	44.8	29.1	16.9	88.0	51.5	76.9	85.3	24.5	4
41.9	24.7	48.9	52.5	46.6	30.4	18.0	88.6	53.3	78.2	86.5	25.1	5
43.6	26.0	50.1	53.1	48.4	31.7	19.2	89.2	55.1	79.5	87.6	25.7	6
45.3	27.2	51.2	53.7	50.1	33.0	20.3	89.9	56.9	80.8	88.8	26.3	7
47.1	28.5	52.4	54.3	51.9	34.3	21.5	90.5	58.7	82.1	89.9	26.9	8
48.8	29.7	53.5	54.9	53.6	35.5	22.6	91.1	60.4	83.4	91.0	27.5	9
5950.5	2531.0	8254.7	1755.5	6055.4	2606.8	8323.7	1791.7	6162.2	2684.8	8332.2	1828.1	10
51.3	32.2	55.9	56.1	57.2	36.8	24.9	92.3	64.0	86.1	93.3	28.7	11
53.0	33.5	57.0	56.7	58.9	38.1	26.0	92.9	65.8	87.4	94.4	29.4	12
54.7	34.7	58.2	57.3	60.7	39.4	27.2	93.5	67.6	88.7	95.6	30.0	13
56.5	36.0	59.3	57.9	62.5	40.7	28.3	94.1	69.4	90.0	96.7	30.6	14
58.2	37.2	60.5	58.5	64.2	42.0	29.5	94.7	71.2	91.3	97.8	31.2	15
60.0	38.5	61.6	59.1	66.0	43.3	30.6	95.3	73.0	92.7	99.0	31.8	16
61.7	39.7	62.8	59.7	67.8	44.6	31.8	95.9	74.8	94.0	100.1	32.4	17
63.4	41.0	63.9	60.3	69.5	45.9	32.9	96.5	76.6	95.3	101.2	33.0	18
65.1	42.2	65.1	60.9	71.3	47.2	34.0	97.1	78.4	96.6	102.4	33.6	19
5967.9	2543.5	8266.3	1761.5	6073.1	2619.7	8335.2	1797.7	6180.2	2697.9	8343.5	1834.2	20
67.6	44.7	67.4	62.1	74.8	48.5	35.3	98.3	80.2	99.7	104.6	34.9	21
69.3	46.0	68.6	62.7	76.6	49.8	36.5	98.9	82.0	2700.6	105.8	35.5	22
71.1	47.2	69.7	63.3	78.4	51.1	37.6	99.5	83.8	01.9	106.9	36.1	23
72.8	48.5	70.9	63.9	80.2	52.4	38.8	100.2	85.6	03.2	108.0	36.7	24
74.6	49.7	72.0	64.5	81.9	53.7	40.0	100.8	87.3	04.6	109.2	37.3	25
76.3	51.0	73.2	65.1	83.7	55.0	41.1	101.4	89.1	05.9	110.3	37.9	26
78.0	52.2	74.3	65.7	85.5	56.3	42.2	102.0	90.9	07.2	111.4	38.5	27
80.0	53.5	75.5	66.3	87.2	57.6	43.3	102.6	92.7	08.5	112.6	39.1	28
81.5	54.8	76.6	66.9	89.0	58.9	44.5	103.2	94.5	09.9	113.7	39.7	29
5985.3	2556.0	8277.8	1767.5	6090.8	2632.6	8346.6	1803.8	6198.3	2711.2	8344.8	1840.4	30
83.0	57.3	78.9	68.1	92.6	60.2	45.8	104.4	96.3	12.5	116.0	41.0	31
84.8	58.5	80.1	68.7	94.3	61.5	47.0	105.0	98.1	13.9	117.1	41.6	32
86.5	59.8	81.2	69.3	96.1	62.8	48.3	105.6	100.0	15.2	118.2	42.2	33
88.2	61.1	82.4	69.9	97.9	64.1	49.6	106.2	101.9	16.5	119.3	42.8	34
90.0	62.3	83.5	70.5	99.7	65.4	50.9	106.8	103.8	17.8	120.4	43.4	35
91.7	63.6	84.7	71.1	101.5	66.7	52.2	107.4	105.7	19.2	121.6	44.0	36
93.4	64.8	85.9	71.7	103.2	68.0	53.5	108.0	107.6	20.5	122.7	44.6	37
95.2	66.1	87.0	72.3	105.0	69.3	54.8	108.6	109.5	21.8	123.9	45.3	38
6001.0	67.4	88.2	72.9	106.8	70.6	56.1	109.3	111.4	23.2	125.0	45.9	39
6002.7	2568.6	8289.3	1773.5	6108.6	2645.5	8358.0	1809.9	6216.4	2724.5	8356.1	1846.5	40
104.5	69.9	90.5	73.1	108.6	71.9	57.4	110.5	113.3	24.5	126.1	46.1	41
106.2	71.2	91.6	73.8	110.4	73.2	58.7	111.1	115.2	25.8	127.2	46.7	42
108.0	72.4	92.8	74.4	112.1	74.5	60.0	111.7	117.1	27.1	128.3	47.3	43
109.7	73.7	93.9	75.0	113.9	75.8	61.3	112.3	119.0	28.4	129.4	47.9	44
111.5	75.0	95.1	75.6	115.7	77.1	62.6	112.9	120.9	29.7	130.5	48.5	45
113.2	76.2	96.2	76.2	117.5	78.4	63.9	113.5	122.8	31.0	131.6	49.1	46
115.0	77.5	97.4	76.8	119.3	79.7	65.2	114.1	124.7	32.3	132.7	49.7	47
116.7	78.8	98.5	77.4	121.1	81.0	66.5	114.7	126.6	33.6	133.8	50.3	48
118.5	80.0	99.7	78.0	122.9	82.3	67.8	115.3	128.5	34.9	134.9	50.9	49
6020.2	2581.3	8300.8	1779.5	6126.4	2658.5	8369.4	1815.9	6234.6	2737.9	8367.4	1852.6	50
120.2	82.6	101.9	80.2	124.7	83.6	69.1	116.6	130.4	36.2	136.0	51.5	51
121.9	83.9	103.1	80.8	126.5	84.9	70.4	117.2	132.3	37.5	137.1	52.1	52
123.7	85.1	104.2	81.4	128.3	86.2	71.7	117.8	134.2	38.8	138.2	52.7	53
125.4	86.4	105.4	82.0	130.1	87.5	73.0	118.4	136.1	40.1	139.3	53.3	54
127.2	87.7	106.5	82.6	131.9	88.8	74.3	119.0	138.0	41.4	140.4	53.9	55
129.0	88.9	107.7	83.2	133.7	90.1	75.6	119.6	140.0	42.7	141.5	54.5	56
130.8	90.2	108.8	83.8	135.5	91.4	76.9	120.2	141.9	44.0	142.6	55.1	57
132.5	91.5	110.0	84.4	137.3	92.7	78.2	120.8	143.8	45.3	143.7	55.7	58
134.3	92.8	111.1	85.0	139.1	94.0	79.5	121.4	145.7	46.6	144.8	56.3	59

TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

I	95°				96°				97°			
	T	E	C	M	T	E	C	M	T	E	C	M
0	6252.8	2757.3	8448.7	1358.8	6363.4	2833.2	8515.9	1895.8	6476.2	2917.3	8582.5	1933.1
1	54.6	52.7	42.8	57.4	65.3	34.6	17.0	96.4	78.1	18.7	83.6	33.7
2	56.5	54.0	52.1	60.0	67.1	35.9	18.2	97.0	80.0	20.2	84.7	34.3
3	58.3	55.3	52.2	60.6	69.0	37.3	19.3	97.6	81.9	21.6	85.8	34.9
4	60.1	56.0	54.3	61.2	70.9	38.7	20.4	98.2	83.8	23.0	86.9	35.6
5	62.0	56.7	54.9	61.8	72.7	40.1	21.5	98.9	85.7	24.4	88.0	36.2
6	63.8	57.4	55.8	62.9	74.6	41.5	22.6	99.5	87.6	25.9	89.1	36.8
7	65.6	60.7	56.6	63.1	76.5	42.9	23.7	100.1	89.5	27.3	90.2	37.4
8	67.4	62.1	57.7	63.7	78.3	44.3	24.8	100.7	91.4	28.7	91.3	38.1
9	69.3	63.4	58.8	64.3	80.2	45.7	25.9	101.3	93.3	30.1	92.4	38.7
10	6271.1	2764.8	8459.9	1864.9	6382.1	2847.0	8527.1	1902.0	6495.2	2931.6	8593.5	1939.3
11	72.9	66.1	61.1	65.5	83.9	48.4	28.2	102.6	97.1	33.0	94.6	39.9
12	74.8	67.5	62.2	66.1	85.8	49.8	29.3	103.2	99.0	34.4	95.7	40.6
13	76.6	68.9	63.3	66.7	87.7	51.2	30.4	103.8	100.9	35.8	96.9	41.2
14	78.4	70.2	64.4	67.4	89.5	52.6	31.5	104.4	102.8	37.3	98.0	41.8
15	80.3	71.6	65.6	68.0	91.4	54.0	32.6	105.1	104.7	38.7	99.1	42.4
16	82.1	72.9	66.7	68.6	93.3	55.4	33.7	105.7	106.6	40.1	100.2	43.1
17	83.9	74.3	67.8	69.2	95.1	56.8	34.9	106.3	108.5	41.6	101.3	43.7
18	85.8	75.6	68.9	69.8	97.0	58.2	36.0	106.9	110.5	43.0	102.4	44.3
19	87.6	77.0	70.0	70.4	98.9	59.6	37.1	107.5	112.4	44.4	103.5	44.9
20	6289.4	2778.4	8471.2	1871.1	6400.8	2861.0	8538.2	1908.2	6514.3	2945.9	8604.6	1945.6
21	91.3	79.7	72.3	71.7	102.6	62.4	39.3	108.8	116.2	47.3	105.7	46.2
22	93.1	81.1	73.4	72.3	104.5	63.8	40.4	109.4	118.1	48.7	106.8	46.8
23	95.0	82.4	74.5	72.9	106.4	65.2	41.5	110.0	120.0	50.2	107.9	47.4
24	96.8	83.8	75.7	73.5	108.3	66.6	42.6	110.7	121.9	51.6	109.0	48.1
25	98.6	85.1	76.8	74.1	110.1	68.0	43.7	111.3	123.8	53.1	110.1	48.7
26	6300.5	86.5	77.9	74.8	112.0	69.4	44.9	111.9	125.8	54.5	111.2	49.3
27	102.3	87.9	79.0	75.4	113.9	70.8	46.0	112.5	127.7	55.9	112.3	50.0
28	104.2	89.2	80.1	76.0	115.8	72.2	47.1	113.1	129.6	57.4	113.4	50.6
29	106.0	90.6	81.3	76.6	117.7	73.6	48.2	113.8	131.5	58.8	114.5	51.2
30	6307.9	2792.0	8482.4	1877.2	6419.5	2875.0	8549.3	1914.4	6533.4	2960.2	8615.6	1951.8
31	109.7	93.3	83.5	77.8	119.5	76.4	50.4	115.0	135.3	61.7	116.7	52.5
32	115.4	94.7	84.6	78.5	121.4	77.8	51.5	115.6	137.2	63.1	117.8	53.1
33	134.4	96.1	85.7	79.1	123.2	79.2	52.6	116.2	139.2	64.6	118.9	53.7
34	152.5	97.4	86.9	79.7	125.1	80.6	53.7	116.9	141.1	66.0	120.0	54.3
35	171.1	98.8	88.0	80.3	126.9	82.0	54.8	117.5	143.0	67.5	121.1	55.0
36	189.9	2800.2	89.1	80.9	128.8	83.4	56.0	118.1	144.9	68.9	122.1	55.6
37	208.8	01.5	90.2	81.5	130.7	84.8	57.1	118.7	146.8	70.4	123.2	56.2
38	226.6	02.9	91.3	82.2	132.6	86.2	58.2	119.4	148.8	71.8	124.3	56.8
39	245.5	04.3	92.5	82.8	134.5	87.6	59.3	120.0	150.7	73.3	125.4	57.5
40	6326.3	2805.6	8493.6	1883.4	6438.4	2889.0	8560.4	1920.6	6552.6	2974.7	8626.5	1958.1
41	282.2	07.0	94.7	84.0	140.2	90.4	61.5	121.2	154.5	76.1	127.6	58.7
42	300.0	08.4	95.8	84.6	142.1	91.8	62.6	121.8	156.5	77.6	128.7	59.4
43	319.9	09.8	96.9	85.3	144.0	93.2	63.7	122.5	158.4	79.0	129.8	60.0
44	339.7	11.1	98.1	85.9	145.9	94.6	64.8	123.1	160.3	80.5	130.9	60.6
45	359.6	12.5	99.2	86.5	147.8	96.1	65.9	123.7	162.2	81.9	132.0	61.2
46	379.4	13.9	8500.3	87.1	149.7	97.5	67.0	124.3	164.2	83.4	133.1	61.9
47	399.3	15.3	01.4	87.7	151.6	98.9	68.1	125.0	166.1	84.8	134.2	62.5
48	419.1	16.6	02.5	88.3	153.5	2900.3	69.2	125.6	168.0	86.3	135.3	63.1
49	439.0	18.0	03.6	89.0	155.4	01.7	70.3	126.2	170.0	87.8	136.4	63.7
50	6344.8	2819.4	8504.8	1889.6	6457.2	2903.1	8571.5	1926.8	6571.9	2988.2	8637.5	1964.4
51	467.2	20.8	05.9	90.2	157.1	104.5	72.6	127.5	171.8	90.7	138.6	65.0
52	486.6	22.1	07.0	90.8	159.0	106.0	73.7	128.1	173.7	92.1	139.7	65.6
53	504.4	23.5	08.1	91.4	160.9	107.4	74.8	128.7	175.7	93.6	140.8	66.3
54	523.3	24.9	09.2	92.1	162.8	108.8	75.9	129.3	177.6	95.0	141.9	66.9
55	541.1	26.3	10.3	92.7	164.7	110.2	77.0	129.9	179.6	96.5	143.0	67.5
56	560.0	27.7	11.5	93.3	166.6	111.6	78.1	130.6	181.5	98.0	144.1	68.1
57	578.8	29.0	12.6	93.9	168.5	113.0	79.2	131.2	183.4	99.4	145.2	68.8
58	597.7	30.4	13.7	94.5	170.4	114.5	80.3	131.8	185.3	100.9	146.3	69.4
59	616.6	31.8	14.8	95.1	172.3	115.9	81.4	132.4	187.3	102.3	147.3	70.0



TABLE II.—FUNCTIONS OF A ONE-DEGREE CURVE

$\Delta$	T	E	C	M
98° 0	659.2	3003.8	8648.4	1970.7
10	6610.6	18.4	594	77.0
20	30.1	70.3	81.3	
30	49.6	47.9	81.2	89.6
40	69.2	62.8	92.0	95.9
50	88.8	77.7	8702.9	2002.2
99° 0	6708.6	92.7	13.7	08.5
10	28.4	3107.7	24.5	14.9
20	48.2	22.9	35.3	21.2
30	68.1	38.1	46.1	27.6
40	88.1	53.3	56.9	33.9
50	6808.2	68.7	67.6	40.3
100° 0	6828.3	318.1	8778.3	2046.7
10	4.5	95.6	89.0	33.1
20	68.8	32.15	99.7	59.5
30	99.2	30.8	8810.4	65.9
40	6909.6	46.5	21.0	72.3
50	30.1	62.3	31.7	78.7
101° 0	506	78.1	42.3	85.1
10	71.3	94.1	52.9	91.6
20	92.0	3310.1	63.4	98.0
30	7012.7	26.1	74.0	2104.5
40	33.6	42.3	84.5	10.9
50	54.5	59.5	95.0	17.4
102° 0	7055.5	3374.9	8905.5	2123.9
10	96.6	91.2	16.0	30.3
20	717.8	3407.7	26.5	36.8
30	39.0	24.3	36.0	43.3
40	60.3	40.9	47.4	49.8
50	81.7	57.6	57.8	56.3
103° 0	7203.2	74.4	68.1	62.9
10	24.7	91.3	78.5	69.4
20	46.3	3508.2	88.9	75.9
30	68.0	25.2	99.2	82.5
40	89.8	42.4	9005.5	89.0
50	7311.7	59.6	19.8	95.6
104° 0	7333.6	3576.8	9030.1	2202.1
10	55.6	94.2	40.3	08.7
20	77.8	3611.7	50.5	15.3
30	99.9	29.2	60.7	21.9
40	7022.2	46.8	70.9	28.5
50	44.6	64.5	81.1	35.1
105° 0	67.0	82.3	91.3	41.7
10	29.6	3700.2	9101.4	48.3
20	7512.2	18.2	11.5	54.9
30	34.9	36.2	21.6	61.5
40	57.7	54.4	31.7	68.2
50	80.5	72.6	41.8	74.8
106° 0	7603.5	3791.0	9151.8	2281.5
10	26.6	3809.4	61.8	88.1
20	49.7	27.9	71.8	94.8
30	72.3	46.5	81.8	2301.4
40	96.3	65.2	91.8	08.1
50	7719.7	84.0	9201.7	14.8
107° 0	43.2	3902.9	11.6	21.5
10	66.8	21.9	21.5	28.2
20	90.5	4.9	31.4	34.9
30	7814.3	60.1	41.3	41.7
40	38.1	79.4	51.1	48.4
50	62.1	98.7	61.0	55.1

$\Delta$	T	E	C	M
108° 0	7886.2	4018.2	9270.8	2361.8
10	7910.4	37.8	80.6	68.6
20	34.6	57.4	90.3	75.3
30	59.0	77.2	9300.1	82.1
40	83.4	97.1	09.8	88.9
50	8008.0	4117.0	19.5	95.8
109° 0	32.7	37.1	29.2	2402.4
10	57.4	57.3	38.9	09.2
20	82.3	77.5	48.5	16.0
30	8107.3	97.9	58.1	22.8
40	32.3	4218.4	67.8	29.6
50	57.5	39.0	77.3	36.4
110° 0	8182.8	4259.7	9387.0	2443.3
10	8208.2	80.5	96.5	50.1
20	33.7	4301.4	9406.0	56.9
30	59.3	22.4	15.5	63.8
40	85.0	43.6	25.0	70.6
50	8310.8	64.8	34.5	77.5
111° 0	36.7	86.1	43.9	84.3
10	62.7	4407.6	53.3	91.2
20	88.9	29.2	62.8	98.1
30	8415.1	50.9	72.1	2504.9
40	41.5	72.7	81.5	11.9
50	68.0	94.6	90.9	18.8
112° 0	8494.6	4516.6	9500.2	2525.7
10	8521.3	38.8	18.8	36.6
20	48.1	61.1	28.1	39.5
30	75.0	83.4	37.1	46.4
40	8602.1	4606.0	37.3	53.4
50	29.3	28.6	46.5	60.3
113° 0	56.6	51.3	55.7	67.2
10	84.0	74.2	64.9	74.2
20	8711.5	97.2	74.1	81.2
30	39.2	4720.3	83.3	88.1
40	67.0	43.6	92.4	95.1
50	94.9	66.9	9601.5	2602.1
114° 0	8822.9	4790.4	9610.6	2609.1
10	51.0	4814.1	19.6	16.1
20	79.3	37.8	28.7	23.1
30	8907.7	61.7	37.7	30.1
40	36.3	85.7	46.7	37.1
50	64.9	4909.9	55.7	44.1
115° 0	93.8	34.1	64.7	51.1
10	9022.7	58.6	73.6	58.1
20	51.7	83.1	82.5	65.2
30	80.9	5007.8	91.4	72.2
40	9110.3	32.6	9700.3	79.3
50	39.8	57.6	09.2	86.3
116° 0	9169.4	5082.7	9718.0	2693.4
10	99.1	5107.9	26.9	2700.5
20	9229.0	33.3	35.7	07.5
30	59.0	58.8	44.4	14.6
40	83.2	94.5	53.2	21.7
50	9318.5	5210.3	61.9	28.8
117° 0	49.9	36.2	70.7	35.9
10	80.5	62.3	79.4	43.0
20	9411.3	88.6	88.0	50.1
30	42.2	5315.0	96.7	57.3
40	73.2	41.5	9805.3	64.4
50	9504.4	68.2	13.9	71.5

TABLE III.—CORRECTIONS (TO BE ADDED)

VALUE FOR A 1° CURVE	DEGREE OF CURVE													VALUE FOR A 1° CURVE
	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°		
100	.00	.00	.00	.01	.01	.01	.01	.01	.01	.01	.02	.02	100	
200	.00	.01	.01	.01	.01	.02	.02	.02	.02	.03	.03	.03	200	
300	.01	.01	.01	.02	.02	.03	.03	.03	.04	.04	.05	.05	300	
400	.01	.01	.02	.02	.03	.03	.04	.05	.05	.06	.06	.07	400	
500	.01	.02	.02	.03	.04	.04	.05	.06	.06	.07	.08	.08	500	
600	.01	.02	.03	.04	.05	.05	.06	.07	.08	.08	.09	.10	600	
700	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	700	
800	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.13	800	
900	.02	.03	.04	.05	.07	.08	.09	.10	.11	.12	.14	.15	900	
1000	.02	.03	.05	.06	.07	.09	.10	.11	.13	.14	.15	.16	1000	
1100	.02	.04	.05	.07	.08	.10	.11	.12	.14	.15	.17	.18	1100	
1200	.02	.04	.06	.07	.09	.10	.12	.14	.15	.17	.18	.20	1200	
1300	.02	.04	.06	.08	.10	.11	.13	.15	.16	.18	.20	.21	1300	
1400	.03	.05	.07	.09	.10	.12	.14	.16	.18	.19	.21	.23	1400	
1500	.03	.05	.07	.09	.11	.13	.15	.17	.19	.21	.23	.25	1500	
1600	.03	.05	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	1600	
1700	.03	.06	.08	.10	.13	.15	.17	.19	.21	.23	.26	.28	1700	
1800	.03	.06	.09	.11	.13	.16	.18	.20	.23	.25	.27	.30	1800	
1900	.04	.06	.09	.12	.14	.17	.19	.21	.24	.26	.29	.31	1900	
2000	.04	.07	.10	.12	.15	.17	.20	.23	.25	.28	.30	.33	2000	
2100	.04	.07	.10	.13	.16	.18	.21	.24	.26	.29	.32	.35	2100	
2200	.04	.07	.10	.13	.16	.19	.22	.25	.28	.30	.33	.36	2200	
2300	.04	.08	.11	.14	.17	.20	.23	.26	.29	.32	.35	.38	2300	
2400	.05	.08	.11	.15	.18	.21	.24	.27	.30	.33	.36	.39	2400	
2500	.05	.09	.12	.15	.19	.22	.25	.28	.31	.35	.38	.41	2500	
2600	.05	.09	.12	.16	.19	.23	.26	.29	.33	.36	.39	.43	2600	
2700	.05	.09	.13	.16	.20	.24	.27	.30	.34	.37	.41	.44	2700	
2800	.05	.10	.13	.17	.21	.24	.28	.32	.35	.39	.42	.46	2800	
2900	.06	.10	.14	.18	.21	.25	.29	.33	.36	.40	.44	.48	2900	
3000	.06	.10	.14	.18	.22	.26	.30	.34	.38	.42	.45	.49	3000	
3100	.06	.11	.15	.19	.23	.27	.31	.35	.39	.43	.47	.51	3100	
3200	.06	.11	.15	.19	.24	.28	.32	.36	.40	.44	.48	.53	3200	
3300	.06	.11	.16	.20	.24	.29	.33	.37	.42	.46	.50	.54	3300	
3400	.06	.12	.16	.21	.25	.30	.34	.38	.43	.47	.52	.56	3400	
3500	.07	.12	.17	.21	.26	.30	.35	.40	.44	.49	.53	.58	3500	
3600	.07	.12	.17	.22	.27	.31	.36	.41	.45	.50	.55	.59	3600	
3700	.07	.13	.18	.23	.27	.32	.37	.42	.47	.51	.56	.61	3700	
3800	.07	.13	.18	.23	.28	.33	.38	.43	.48	.53	.58	.62	3800	
3900	.07	.13	.19	.24	.29	.34	.39	.44	.49	.54	.59	.64	3900	
4000	.08	.14	.19	.24	.30	.35	.40	.45	.50	.55	.61	.66	4000	
4100	.08	.14	.20	.25	.30	.36	.41	.46	.52	.57	.62	.67	4100	
4200	.08	.14	.20	.26	.31	.37	.42	.47	.53	.58	.64	.69	4200	
4300	.08	.15	.20	.26	.32	.37	.43	.49	.54	.60	.65	.71	4300	
4400	.08	.15	.21	.27	.33	.38	.44	.50	.55	.61	.67	.72	4400	
4500	.09	.15	.21	.27	.33	.39	.45	.51	.57	.62	.68	.74	4500	
4600	.09	.16	.22	.28	.34	.40	.46	.52	.58	.64	.70	.76	4600	
4700	.09	.16	.22	.29	.35	.41	.47	.53	.59	.65	.71	.77	4700	
4800	.09	.16	.23	.29	.36	.42	.48	.54	.60	.67	.73	.79	4800	
4900	.09	.17	.23	.30	.36	.43	.49	.55	.62	.68	.74	.81	4900	
5000	.10	.17	.24	.30	.37	.44	.50	.56	.63	.69	.76	.82	5000	
5100	.10	.17	.24	.31	.38	.44	.51	.58	.64	.71	.77	.84	5100	
5200	.10	.18	.25	.32	.38	.45	.52	.59	.65	.72	.79	.85	5200	
5300	.10	.18	.25	.32	.39	.46	.53	.60	.67	.73	.80	.87	5300	
5400	.10	.18	.26	.33	.40	.47	.54	.61	.68	.75	.82	.89	5400	
5500	.10	.19	.26	.34	.41	.48	.55	.62	.69	.76	.83	.90	5500	
5600	.11	.19	.27	.34	.41	.49	.56	.63	.70	.78	.85	.92	5600	
5700	.11	.19	.27	.35	.42	.50	.57	.64	.72	.79	.86	.94	5700	
5800	.11	.20	.28	.35	.43	.51	.58	.65	.73	.80	.88	.95	5800	
5900	.11	.20	.28	.36	.44	.51	.59	.67	.74	.82	.89	.97	5900	
6000	.11	.20	.29	.37	.44	.52	.60	.68	.76	.83	.91	.99	6000	

TABLE III.—CORRECTIONS (TO BE ADDED)

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VALUE FOR A 10° CURVE	DEGREE OF CURVE													VALUE FOR A 10° CURVE
	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°		
6100	.12	.21	.29	.37	.45	.53	.61	.69	.77	.85	.92	1.00	6100	
6200	.12	.21	.30	.38	.46	.54	.62	.70	.78	.86	.94	1.02	6200	
6300	.12	.21	.30	.38	.47	.55	.63	.71	.79	.87	.95	1.04	6300	
6400	.12	.22	.30	.39	.47	.56	.64	.72	.81	.89	.97	1.05	6400	
6500	.12	.22	.31	.40	.48	.57	.65	.73	.82	.90	.98	1.07	6500	
6600	.13	.22	.31	.40	.49	.57	.66	.75	.83	.91	1.00	1.09	6600	
6700	.13	.23	.32	.41	.50	.58	.67	.76	.84	.93	1.01	1.10	6700	
6800	.13	.23	.32	.41	.50	.59	.68	.77	.86	.94	1.03	1.12	6800	
6900	.13	.23	.33	.42	.51	.60	.69	.78	.87	.96	1.05	1.13	6900	
7000	.13	.24	.33	.43	.52	.61	.70	.79	.88	.97	1.06	1.15	7000	
7100	.13	.24	.34	.43	.53	.62	.71	.80	.89	.98	1.08	1.17	7100	
7200	.14	.25	.34	.44	.53	.63	.72	.81	.91	1.00	1.09	1.18	7200	
7300	.14	.25	.35	.44	.54	.64	.73	.82	.92	1.01	1.11	1.20	7300	
7400	.14	.26	.35	.45	.55	.64	.74	.84	.93	1.03	1.12	1.22	7400	
7500	.14	.26	.36	.46	.56	.65	.75	.85	.94	1.04	1.14	1.23	7500	
7600	.14	.26	.36	.46	.56	.66	.76	.86	.96	1.05	1.15	1.25	7600	
7700	.15	.26	.37	.47	.57	.67	.77	.87	.97	1.07	1.17	1.26	7700	
7800	.15	.27	.37	.48	.58	.68	.78	.88	.98	1.08	1.18	1.28	7800	
7900	.15	.27	.38	.48	.58	.69	.79	.89	.99	1.09	1.20	1.30	7900	
8000	.15	.27	.38	.49	.59	.70	.80	.90	1.01	1.11	1.21	1.32	8000	
8200	.16	.28	.39	.50	.61	.71	.82	.93	1.03	1.14	1.24	1.35	8200	
8400	.16	.29	.40	.51	.62	.73	.84	.95	1.06	1.16	1.27	1.38	8400	
8600	.16	.29	.41	.52	.64	.75	.86	.97	1.08	1.19	1.30	1.41	8600	
8800	.17	.30	.42	.54	.65	.77	.88	.99	1.11	1.22	1.33	1.45	8800	
9000	.17	.31	.43	.55	.67	.78	.90	1.02	1.13	1.25	1.36	1.48	9000	
9200	.18	.31	.44	.56	.68	.80	.92	1.04	1.16	1.28	1.39	1.51	9200	
9400	.18	.32	.45	.57	.70	.82	.94	1.06	1.18	1.30	1.42	1.55	9400	
9600	.18	.33	.46	.58	.71	.84	.96	1.08	1.21	1.33	1.45	1.58	9600	
9800	.19	.33	.47	.60	.73	.85	.98	1.11	1.23	1.36	1.48	1.61	9800	
	14°	15°	16°	18°	20°	22°	24°	26°	28°	30°	35°	40°		
100	.02	.02	.02	.02	.03	.03	.03	.03	.04	.04	.04	.05	100	
200	.04	.04	.04	.05	.05	.06	.06	.07	.07	.08	.09	.10	200	
300	.05	.06	.06	.07	.08	.08	.09	.10	.11	.12	.13	.15	300	
400	.07	.08	.08	.09	.10	.11	.12	.13	.14	.15	.18	.21	400	
500	.09	.09	.10	.11	.13	.14	.15	.17	.18	.19	.22	.26	500	
600	.11	.11	.12	.14	.15	.17	.18	.20	.21	.23	.27	.31	600	
700	.12	.13	.14	.16	.18	.20	.21	.23	.25	.27	.31	.36	700	
800	.14	.15	.16	.18	.20	.22	.24	.27	.29	.31	.36	.41	800	
900	.16	.17	.18	.21	.23	.25	.28	.30	.32	.35	.40	.46	900	
1000	.18	.19	.20	.23	.25	.28	.31	.33	.36	.39	.45	.51	1000	
1100	.19	.21	.22	.25	.28	.31	.34	.36	.39	.42	.49	.57	1100	
1200	.21	.23	.24	.27	.30	.34	.37	.40	.43	.46	.54	.62	1200	
1300	.23	.25	.26	.30	.33	.36	.40	.43	.46	.50	.58	.67	1300	
1400	.25	.27	.28	.32	.36	.39	.43	.47	.50	.54	.63	.72	1400	
1500	.27	.28	.30	.34	.38	.42	.46	.50	.54	.58	.67	.77	1500	
1600	.28	.30	.32	.37	.41	.45	.49	.53	.57	.61	.72	.82	1600	
1700	.30	.32	.34	.39	.43	.48	.52	.56	.61	.65	.76	.87	1700	
1800	.32	.34	.37	.41	.46	.50	.55	.60	.64	.69	.81	.93	1800	
1900	.34	.36	.39	.43	.48	.53	.58	.63	.68	.73	.85	.98	1900	
2000	.35	.38	.41	.46	.51	.56	.61	.66	.71	.77	.90	1.03	2000	
2100	.37	.40	.43	.48	.53	.59	.64	.70	.75	.81	.94	1.08	2100	
2200	.39	.42	.45	.50	.56	.62	.67	.73	.79	.84	.98	1.13	2200	
2300	.41	.44	.47	.53	.58	.64	.70	.76	.82	.88	1.03	1.18	2300	
2400	.42	.46	.49	.55	.61	.67	.73	.80	.86	.92	1.08	1.24	2400	
2500	.44	.47	.51	.57	.64	.70	.76	.83	.89	.96	1.12	1.29	2500	
2600	.46	.49	.53	.59	.66	.73	.80	.86	.93	1.00	1.17	1.34	2600	
2700	.48	.51	.55	.62	.69	.76	.83	.90	.97	1.04	1.21	1.39	2700	
2800	.50	.53	.57	.64	.71	.78	.86	.93	1.00	1.07	1.26	1.44	2800	
2900	.51	.55	.59	.66	.74	.81	.89	.96	1.04	1.11	1.30	1.49	2900	

TABLE III.—CORRECTIONS (TO BE ADDED)

VALUE FOR A 1° CURVE	DEGREE OF CURVE												VALUE FOR A 1° CURVE
	14°	15°	16°	18°	20°	22°	24°	26°	28°	30°	35°	40°	
3000	.53	.57	.61	.69	.76	.84	.92	.99	1.07	1.15	1.35	1.54	3000
3100	.55	.59	.63	.71	.79	.87	.95	1.03	1.11	1.19	1.39	1.60	3100
3200	.57	.61	.65	.73	.81	.90	.98	1.06	1.14	1.23	1.44	1.65	3200
3300	.58	.63	.67	.75	.84	.92	1.01	1.09	1.18	1.27	1.48	1.70	3300
3400	.60	.65	.69	.78	.86	.95	1.04	1.13	1.22	1.30	1.53	1.75	3400
3500	.62	.66	.71	.80	.89	.98	1.07	1.16	1.25	1.34	1.57	1.80	3500
3600	.64	.68	.73	.82	.91	1.01	1.10	1.19	1.29	1.38	1.62	1.85	3600
3700	.65	.70	.75	.85	.94	1.04	1.13	1.23	1.32	1.42	1.66	1.90	3700
3800	.67	.72	.77	.87	.97	1.06	1.16	1.26	1.36	1.46	1.71	1.96	3800
3900	.69	.74	.79	.89	.99	1.09	1.19	1.29	1.39	1.50	1.75	2.01	3900
4000	.71	.76	.81	.91	1.02	1.12	1.22	1.33	1.43	1.53	1.80	2.06	4000
4100	.73	.78	.83	.94	1.04	1.15	1.25	1.36	1.47	1.57	1.84	2.11	4100
4200	.74	.80	.85	.96	1.07	1.18	1.28	1.39	1.50	1.61	1.89	2.16	4200
4300	.76	.82	.87	.98	1.09	1.20	1.31	1.43	1.54	1.65	1.93	2.21	4300
4400	.78	.84	.89	1.01	1.12	1.23	1.35	1.46	1.57	1.69	1.98	2.26	4400
4500	.80	.85	.91	1.03	1.14	1.26	1.38	1.49	1.61	1.73	2.02	2.32	4500
4600	.81	.87	.93	1.05	1.17	1.29	1.41	1.53	1.64	1.76	2.06	2.37	4600
4700	.83	.89	.95	1.07	1.19	1.32	1.44	1.56	1.68	1.80	2.11	2.42	4700
4800	.85	.91	.97	1.10	1.22	1.34	1.47	1.59	1.72	1.84	2.15	2.47	4800
4900	.87	.93	.99	1.12	1.25	1.37	1.50	1.62	1.75	1.88	2.20	2.52	4900
5000	.88	.95	1.01	1.14	1.27	1.40	1.53	1.66	1.79	1.92	2.24	2.57	5000
5100	.90	.97	1.03	1.17	1.30	1.43	1.56	1.69	1.82	1.96	2.29	2.62	5100
5200	.92	.99	1.05	1.19	1.32	1.46	1.59	1.72	1.86	1.99	2.33	2.68	5200
5300	.94	1.01	1.07	1.21	1.35	1.48	1.62	1.76	1.89	2.03	2.38	2.73	5300
5400	.96	1.03	1.10	1.23	1.37	1.51	1.65	1.79	1.93	2.07	2.42	2.78	5400
5500	.97	1.04	1.12	1.26	1.40	1.54	1.68	1.82	1.97	2.11	2.47	2.83	5500
5600	.99	1.06	1.14	1.28	1.42	1.57	1.71	1.86	2.00	2.15	2.51	2.88	5600
5700	1.01	1.08	1.16	1.30	1.45	1.60	1.74	1.89	2.04	2.19	2.56	2.93	5700
5800	1.03	1.10	1.18	1.33	1.47	1.62	1.77	1.92	2.07	2.22	2.60	2.99	5800
5900	1.04	1.12	1.20	1.35	1.50	1.65	1.80	1.96	2.11	2.26	2.65	3.04	5900
6000	1.06	1.14	1.22	1.37	1.52	1.68	1.83	1.99	2.14	2.30	2.69	3.09	6000
6100	1.08	1.16	1.24	1.39	1.55	1.71	1.87	2.02	2.18	2.34	2.74	3.14	6100
6200	1.10	1.18	1.26	1.42	1.58	1.74	1.90	2.06	2.22	2.38	2.78	3.19	6200
6300	1.11	1.20	1.28	1.44	1.60	1.76	1.93	2.09	2.25	2.42	2.83	3.24	6300
6400	1.13	1.22	1.30	1.46	1.63	1.79	1.96	2.12	2.29	2.45	2.87	3.29	6400
6500	1.15	1.23	1.32	1.48	1.65	1.82	1.99	2.16	2.32	2.49	2.92	3.35	6500
6600	1.17	1.25	1.34	1.51	1.68	1.85	2.02	2.19	2.36	2.53	2.96	3.40	6600
6700	1.19	1.27	1.36	1.53	1.70	1.88	2.05	2.22	2.39	2.57	3.01	3.45	6700
6800	1.20	1.29	1.38	1.55	1.73	1.90	2.08	2.25	2.43	2.61	3.05	3.50	6800
6900	1.22	1.31	1.40	1.58	1.75	1.93	2.11	2.29	2.47	2.65	3.10	3.55	6900
7000	1.24	1.33	1.42	1.60	1.78	1.96	2.14	2.32	2.50	2.68	3.14	3.60	7000
7100	1.26	1.35	1.44	1.62	1.80	1.99	2.17	2.35	2.54	2.72	3.19	3.65	7100
7200	1.27	1.37	1.46	1.64	1.83	2.02	2.20	2.39	2.57	2.76	3.23	3.71	7200
7300	1.29	1.39	1.48	1.67	1.86	2.04	2.23	2.42	2.61	2.80	3.28	3.76	7300
7400	1.31	1.41	1.50	1.69	1.88	2.07	2.26	2.45	2.65	2.84	3.32	3.81	7400
7500	1.33	1.42	1.52	1.71	1.91	2.10	2.29	2.49	2.68	2.88	3.37	3.86	7500
7600	1.34	1.44	1.54	1.74	1.93	2.13	2.32	2.52	2.72	2.91	3.41	3.91	7600
7700	1.36	1.46	1.56	1.76	1.96	2.16	2.35	2.55	2.75	2.95	3.46	3.96	7700
7800	1.38	1.48	1.58	1.78	1.98	2.18	2.39	2.59	2.79	2.99	3.50	4.01	7800
7900	1.40	1.50	1.60	1.80	2.01	2.21	2.42	2.62	2.82	3.03	3.55	4.07	7900
8000	1.42	1.52	1.62	1.83	2.03	2.24	2.45	2.65	2.86	3.07	3.59	4.12	8000
8200	1.45	1.56	1.66	1.87	2.08	2.30	2.51	2.72	2.93	3.14	3.68	4.22	8200
8400	1.49	1.60	1.70	1.92	2.13	2.35	2.57	2.79	3.00	3.22	3.77	4.32	8400
8600	1.52	1.63	1.74	1.96	2.19	2.41	2.63	2.85	3.07	3.30	3.86	4.43	8600
8800	1.56	1.67	1.78	2.01	2.24	2.46	2.69	2.92	3.15	3.37	3.95	4.53	8800
9000	1.59	1.71	1.83	2.06	2.29	2.52	2.75	2.98	3.22	3.45	4.04	4.63	9000
9200	1.63	1.75	1.87	2.10	2.34	2.58	2.81	3.05	3.29	3.53	4.13	4.74	9200
9400	1.66	1.78	1.91	2.15	2.39	2.63	2.87	3.12	3.36	3.60	4.22	4.84	9400
9600	1.70	1.82	1.95	2.19	2.44	2.69	2.94	3.18	3.43	3.68	4.31	4.94	9600
9800	1.73	1.86	1.99	2.24	2.49	2.74	3.00	3.25	3.50	3.76	4.40	5.04	9800

TABLE IV.—CURVES DESIGNATED BY RADIUS

55

RADIUS	MULTIPLY $10^6$ FUNCTIONS BY	DEGREE OF CURVE
5	.000873	
10	.001745	
15	.002618	
20	.003491	
25	.004363	
30	.005236	
35	.006109	
40	.006981	
45	.007854	
50	.008727	
55	.009599	
60	.010472	
65	.011344	
70	.012217	
75	.013090	
80	.013962	
85	.014835	
90	.015708	
95	.016580	
100	.017453	
105	.018326	
110	.019198	
115	.020071	
120	.020944	
125	.021816	
130	.022689	
135	.023562	
140	.024434	
145	.025307	
150	.026180	
155	.027052	37° 38.3'
160	.027925	36 - 25.2
165	.028797	35 - 16.8
170	.029670	34 - 12.6
175	.030543	33 - 12.2
180	.031415	32 - 15.3
185	.032288	31 - 21.6
190	.033161	30 - 30.9
195	.034033	29 - 42.9
200	.034906	28 - 57.3
205	.035779	28 - 14.0
210	.036651	27 - 32.9
215	.037524	26 - 53.7
220	.038397	26 - 16.4
225	.039269	25 - 40.8
230	.040142	25 - 06.7
235	.041015	24 - 34.1
240	.041887	24 - 03.0
245	.042760	23 - 33.1
250	.043633	23 - 04.4
255	.044505	22 - 36.9
260	.045378	22 - 10.5
265	.046250	21 - 45.1
270	.047123	21 - 20.6
275	.047996	20 - 57.1
280	.048868	20 - 34.4
285	.049741	20 - 12.5
290	.050614	19 - 51.4
295	.051486	19 - 31.0
300	.052359	19 - 11.3

RADIUS	MULTIPLY $10^6$ FUNCTIONS BY	DEGREE OF CURVE
305	.053232	18° 52.2
310	.054104	18 - 33.8
315	.054977	18 - 16.0
320	.055850	17 - 58.7
325	.056722	17 - 42.0
330	.057595	17 - 25.8
335	.058468	17 - 10.0
340	.059340	16 - 54.8
345	.060213	16 - 40.0
350	.061086	16 - 25.6
355	.061958	16 - 11.6
360	.062831	15 - 58.0
365	.063703	15 - 44.8
370	.064576	15 - 32.0
375	.065449	15 - 19.5
380	.066321	15 - 07.3
385	.067194	14 - 55.4
390	.068067	14 - 43.9
395	.068939	14 - 32.7
400	.069812	14 - 21.7
405	.070685	14 - 11.0
410	.071557	14 - 00.6
415	.072430	13 - 50.4
420	.073303	13 - 40.5
425	.074175	13 - 30.8
430	.075048	13 - 21.3
435	.075921	13 - 12.0
440	.076793	13 - 03.0
445	.077666	12 - 54.2
450	.078539	12 - 45.6
455	.079411	12 - 37.1
460	.080284	12 - 28.8
465	.081156	12 - 20.7
470	.082029	12 - 12.8
475	.082902	12 - 05.1
480	.083774	11 - 57.5
485	.084647	11 - 50.1
490	.085520	11 - 42.8
495	.086392	11 - 35.7
500	.087265	11 - 28.7
505	.088138	11 - 21.9
510	.089010	11 - 15.2
515	.089883	11 - 08.6
520	.090756	11 - 02.1
525	.091628	10 - 55.8
530	.092501	10 - 49.6
535	.093374	10 - 43.5
540	.094246	10 - 37.5
545	.095119	10 - 31.7
550	.095992	10 - 25.9
555	.096864	10 - 20.3
560	.097737	10 - 14.7
565	.098609	10 - 09.2
570	.099482	10 - 03.9
575	.100355	9 - 58.6
580	.101227	9 - 53.5
585	.102100	9 - 48.4
590	.102973	9 - 43.4
595	.103845	9 - 38.5
600	.104718	9 - 33.6

TABLE V.—RADII

r	DEGREE OF CURVE									
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
0	Infinite	5729.65	2864.93	1910.08	1432.69	1146.28	955.37	819.02	716.78	637.27
1	34377.4	5635.72	2841.26	1899.53	1426.74	1142.47	952.72	817.08	715.29	636.10
2	17188.7	5544.83	2817.97	1889.09	1420.85	1138.69	950.09	815.14	713.81	634.93
3	114591.6	5456.82	2795.06	1878.77	1415.01	1134.94	947.48	813.22	712.33	633.76
4	85943.7	5371.56	2772.53	1868.56	1409.21	1131.21	944.88	811.30	710.87	632.60
5	68754.9	5288.92	2750.35	1858.47	1403.46	1127.50	942.29	809.40	709.44	631.44
6	57295.8	5208.79	2728.52	1848.48	1397.76	1123.82	939.72	807.50	707.94	630.29
7	49110.7	5131.05	2707.04	1838.59	1392.10	1120.16	937.16	805.61	706.49	629.14
8	42971.8	5055.59	2685.89	1828.82	1386.49	1116.52	934.62	803.73	705.05	627.99
9	38197.2	4982.33	2665.08	1819.14	1380.92	1112.91	932.09	801.86	703.61	626.85
10	34377.5	4911.15	2644.58	1809.57	1375.40	1109.33	929.57	800.00	702.18	625.71
11	31252.3	4841.98	2624.39	1800.10	1369.92	1105.76	927.07	798.14	700.75	624.58
12	28647.9	4774.74	2604.51	1790.73	1364.49	1102.22	924.58	796.30	699.33	623.45
13	26444.2	4709.33	2584.93	1781.45	1359.10	1098.70	922.10	794.46	697.91	622.32
14	24555.4	4645.69	2565.65	1772.27	1353.75	1095.20	919.64	792.63	696.50	621.20
15	22918.3	4583.75	2546.64	1763.18	1348.45	1091.73	917.19	790.81	695.09	620.09
16	21485.9	4523.44	2527.92	1754.19	1343.18	1088.28	914.75	789.00	693.70	618.97
17	20222.1	4464.70	2509.47	1745.29	1337.96	1084.95	912.33	787.20	692.30	617.87
18	19098.6	4407.46	2491.29	1736.48	1332.77	1081.64	909.92	785.40	690.91	616.76
19	18093.4	4351.67	2473.37	1727.75	1327.63	1078.05	907.52	783.62	689.53	615.66
20	17188.8	4297.28	2455.70	1719.12	1322.53	1074.68	905.13	781.84	688.16	614.56
21	16370.2	4244.23	2438.29	1710.57	1317.46	1071.34	902.76	780.07	686.78	613.47
22	15626.1	4192.47	2421.12	1702.10	1312.43	1068.01	900.40	778.31	685.42	612.38
23	14946.8	4141.96	2404.19	1693.72	1307.45	1064.71	898.05	776.55	684.06	611.30
24	14324.0	4092.66	2387.50	1685.42	1302.50	1061.43	895.71	774.81	682.70	610.21
25	13751.0	4044.51	2371.04	1677.20	1297.58	1058.16	893.39	773.07	681.35	609.14
26	13222.1	3997.48	2354.80	1669.06	1292.71	1054.92	891.08	771.34	680.01	608.06
27	12732.4	3951.54	2338.78	1661.00	1287.87	1051.70	888.78	769.61	678.67	606.99
28	12277.7	3906.64	2322.98	1653.01	1283.07	1048.49	886.49	767.90	677.34	605.93
29	11854.3	3862.74	2307.39	1645.11	1278.30	1045.31	884.21	766.19	676.01	604.86
30	11459.2	3819.83	2292.01	1637.28	1273.57	1042.14	881.95	764.49	674.69	603.80
31	11089.5	3777.85	2276.84	1629.52	1268.87	1039.00	879.69	762.80	673.37	602.75
32	10743.0	3736.79	2261.86	1621.84	1264.21	1035.87	877.45	761.11	672.06	601.70
33	10411.5	3696.61	2247.08	1614.22	1259.58	1032.76	875.22	759.43	670.75	600.65
34	10111.1	3657.29	2232.49	1606.68	1254.98	1029.67	873.00	757.76	669.45	599.61
35	9822.18	3618.80	2218.09	1599.21	1250.42	1026.60	870.79	756.10	668.15	598.57
36	9549.34	3581.10	2203.87	1591.81	1245.89	1023.55	868.60	754.44	666.86	597.53
37	9291.25	3544.19	2189.84	1584.48	1241.40	1020.51	866.41	752.80	665.57	596.50
38	9046.75	3508.02	2175.98	1577.21	1236.94	1017.49	864.24	751.16	664.29	595.47
39	8814.78	3472.59	2162.30	1570.01	1232.51	1014.50	862.07	749.52	663.01	594.44
40	8594.42	3437.87	2148.79	1562.88	1228.11	1011.51	859.92	747.89	661.74	593.42
41	8384.80	3403.83	2135.44	1555.81	1223.74	1008.55	857.78	746.27	660.47	592.40
42	8185.16	3370.46	2122.26	1548.80	1219.40	1005.60	855.65	744.66	659.21	591.38
43	7994.81	3337.78	2109.24	1541.86	1215.09	1002.67	853.53	743.06	657.95	590.37
44	7813.11	3305.65	2096.39	1534.98	1210.82	999.76	851.42	741.46	656.69	589.36
45	7639.43	3274.17	2083.68	1528.16	1206.57	996.87	849.32	739.86	655.45	588.36
46	7473.42	3243.29	2071.13	1521.40	1202.35	993.99	847.23	738.28	654.20	587.36
47	7314.41	3212.98	2058.73	1514.70	1198.17	991.13	845.15	736.70	652.96	586.36
48	7162.03	3183.23	2046.48	1508.06	1194.01	988.28	843.08	735.13	651.73	585.36
49	7015.87	3154.03	2034.37	1501.48	1189.88	985.45	841.02	733.56	650.50	584.37
50	6875.55	3125.36	2022.41	1494.95	1185.78	982.64	838.97	732.01	649.27	583.38
51	6740.74	3097.20	2010.59	1488.48	1181.71	979.84	836.93	730.45	648.05	582.40
52	6611.12	3069.55	1998.90	1482.07	1177.65	977.06	834.90	728.91	646.84	581.42
53	6486.38	3042.39	1987.35	1475.71	1173.55	974.29	832.88	727.37	645.63	580.44
54	6366.26	3015.71	1975.93	1469.41	1169.44	971.54	830.88	725.84	644.42	579.47
55	6250.51	2989.48	1964.64	1463.16	1165.70	968.81	828.88	724.31	643.22	578.49
56	6138.90	2963.72	1953.48	1456.96	1161.76	966.09	826.89	722.79	642.02	577.53
57	6031.20	2938.39	1942.44	1450.81	1157.95	963.39	824.91	721.28	640.83	576.56
58	5927.22	2913.49	1931.53	1444.72	1153.97	960.70	822.93	719.77	639.64	575.60
59	5826.76	2889.01	1920.75	1438.68	1150.11	958.02	820.97	718.27	638.45	574.64

TABLE V.—RADII

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I	DEGREE OF CURVE									
	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°
0	573.69	521.67	478.34	441.68	410.28	383.06	359.26	338.27	319.62	302.94
2	571.78	520.10	477.02	440.56	409.31	382.22	358.52	337.62	319.04	302.42
4	569.90	518.54	475.71	439.44	408.34	381.38	357.78	336.96	318.45	301.89
6	568.02	516.99	474.40	438.33	407.38	380.54	357.05	336.31	317.87	301.37
8	566.16	515.44	473.10	437.22	406.42	379.71	356.32	335.66	317.29	300.85
10	564.31	513.91	471.81	436.12	405.47	378.86	355.59	335.01	316.71	300.33
12	562.47	512.38	470.53	435.02	404.53	378.05	354.86	334.37	316.14	299.82
14	560.64	510.87	469.25	433.93	403.58	377.23	354.13	333.73	315.57	299.30
16	558.82	509.36	467.98	432.84	402.65	376.41	353.41	333.09	315.00	298.79
18	557.02	507.86	466.72	431.76	401.71	375.60	352.70	332.45	314.43	298.28
20	555.23	506.38	465.46	430.69	400.78	374.79	351.98	331.82	313.86	297.77
22	553.45	504.90	464.21	429.62	399.86	373.98	351.27	331.18	313.29	297.26
24	551.68	503.42	462.97	428.56	398.94	373.17	350.56	330.55	312.73	296.75
26	549.92	501.96	461.73	427.50	398.02	372.37	349.85	329.93	312.17	296.25
28	548.17	500.51	460.50	426.44	397.11	371.57	349.15	329.30	311.61	295.75
30	546.44	499.06	459.28	425.40	396.20	370.78	348.45	328.68	311.06	295.25
32	544.71	497.62	458.06	424.35	395.30	369.99	347.75	328.06	310.50	294.75
34	543.00	496.19	456.85	423.32	394.40	369.20	347.06	327.44	309.95	294.25
36	541.30	494.77	455.65	422.28	393.50	368.42	346.37	326.83	309.40	293.76
38	539.61	493.36	454.45	421.26	392.61	367.64	345.68	326.21	308.85	293.26
40	537.92	491.96	453.26	420.23	391.72	366.86	344.99	325.60	308.30	292.77
42	536.25	490.56	452.07	419.22	390.84	366.09	344.31	325.00	307.76	292.28
44	534.59	489.17	450.89	418.20	389.96	365.31	343.62	324.39	307.22	291.79
46	532.94	487.79	449.72	417.19	389.08	364.55	342.95	323.79	306.68	291.30
48	531.30	486.42	448.56	416.19	388.21	363.78	342.27	323.18	306.14	290.82
50	529.67	485.05	447.40	415.19	387.34	363.02	341.60	322.59	305.60	290.33
52	528.05	483.69	446.24	414.20	386.48	362.26	340.93	321.99	305.06	289.85
54	526.44	482.34	445.09	413.21	385.62	361.51	340.26	321.39	304.53	289.37
56	524.84	481.00	443.95	412.23	384.77	360.76	339.60	320.80	304.00	288.89
58	523.25	479.67	442.81	411.25	383.91	360.01	338.93	320.21	303.47	288.41

DEGREE OF CURVE	MINUTES										DEGREE OF CURVE
	0'	10'	20'	30'	40'	50'	0'	10'	20'	30'	
20°	287.94	285.58	283.27	280.99	278.75	276.54	20°	287.94	285.58	283.27	20°
21	274.37	272.23	270.13	268.06	266.02	264.02	21	274.37	272.23	270.13	21
22	262.04	260.10	258.18	256.29	254.43	252.60	22	262.04	260.10	258.18	22
23	250.79	249.01	247.26	245.53	243.82	242.14	23	250.79	249.01	247.26	23
24	240.49	238.85	237.24	235.65	234.08	232.54	24	240.49	238.85	237.24	24
25	231.01	229.51	228.02	226.55	225.11	223.68	25	231.01	229.51	228.02	25
26	222.27	220.88	219.51	218.15	216.81	215.49	26	222.27	220.88	219.51	26
27	214.18	212.89	211.62	210.36	209.12	207.89	27	214.18	212.89	211.62	27
28	206.68	205.48	204.30	203.13	201.97	200.83	28	206.68	205.48	204.30	28
29	199.70	198.58	197.48	196.38	195.31	194.24	29	199.70	198.58	197.48	29
30	193.19	192.14	191.11	190.09	189.08	188.09	30	193.19	192.14	191.11	30
31	187.10	186.12	185.16	184.20	183.26	182.32	31	187.10	186.12	185.16	31
32	181.40	180.46	179.58	178.68	177.79	176.92	32	181.40	180.46	179.58	32
33	176.05	175.19	174.34	173.49	172.66	171.83	33	176.05	175.19	174.34	33
34	171.02	170.21	169.40	168.61	167.82	167.05	34	171.02	170.21	169.40	34
35	166.28	165.51	164.76	164.01	163.27	162.53	35	166.28	165.51	164.76	35
36	161.80	161.08	160.37	159.66	158.96	158.27	36	161.80	161.08	160.37	36
37	157.58	156.90	156.22	155.55	154.89	154.23	37	157.58	156.90	156.22	37
38	153.58	152.93	152.29	151.66	151.03	150.41	38	153.58	152.93	152.29	38
39	149.79	149.17	148.57	147.97	147.37	146.78	39	149.79	149.17	148.57	39
40	146.19	145.61	145.03	144.46	143.89	143.33	40	146.19	145.61	145.03	40
41	142.77	142.22	141.67	141.13	140.59	140.05	41	142.77	142.22	141.67	41
42	139.52	138.99	138.47	137.95	137.44	136.93	42	139.52	138.99	138.47	42
43	136.43	135.92	135.43	134.93	134.44	133.96	43	136.43	135.92	135.43	43
44	133.47	132.99	132.52	132.05	131.58	131.12	44	133.47	132.99	132.52	44
45	130.66	130.20	129.75	129.30	128.85	128.41	45	130.66	130.20	129.75	45
46	127.97	127.53	127.09	126.66	126.24	125.81	46	127.97	127.53	127.09	46
47	125.39	124.97	124.56	124.15	123.74	123.33	47	125.39	124.97	124.56	47
48	122.93	122.53	122.13	121.74	121.35	120.96	48	122.93	122.53	122.13	48
49	120.57	120.19	119.81	119.43	119.05	118.68	49	120.57	120.19	119.81	49

DEGREES	MINUTES							
	0'	10'	20'	30'	40'	50'	60'	
00	0000000	00029089	00581177	0087265	0116353	0145439	0174524	890
1	0174524	0203608	0232360	0261769	0290847	0319922	0348995	88
2	0348995	0378065	0407131	0436194	0465253	0494308	0523360	87
3	0523360	0552406	0581448	0610485	0639517	0668544	0697565	86
4	0697565	0726580	0755589	0784591	0813587	0842575	0871557	85
5	0871557	0900532	0929549	0958458	0987408	1016351	1045285	84
6	1045285	1074210	1103126	1132032	1160929	1189816	1218693	83
7	1218693	1247561	1276416	1305262	1334096	1362919	1391731	82
8	1391731	1426053	1449319	1478094	1506857	1535607	1564345	81
9	1564345	1593069	1621779	1650476	1679159	1707828	1736482	80
10	1736482	1765121	1793746	1822355	1850949	1879528	1908090	79
11	1908090	1936636	1965174	1993679	2022176	2050655	2079177	78
12	2079177	2107561	2135988	2164396	2192786	2221158	2249511	77
13	2249511	2277844	2306155	2334454	2362742	2390984	2419219	76
14	2419219	2447433	2475627	2503800	2531952	2560082	2588190	75
15	2588190	2616277	2644342	2672384	2700403	2728400	2756374	74
16	2756374	2784324	2812251	2840153	2868032	2895880	2923717	73
17	2923717	2951522	2979303	3007058	3034788	3062492	3090170	72
18	3090170	3117822	3145448	3173047	3200619	3228164	3255682	71
19	3255682	3283172	3310634	3338069	3365475	3392852	3420201	70
20	3420201	3447521	3474812	3502074	3529306	3556508	3583679	69
21	3583679	3610821	3637932	3665015	3692061	3719079	3746066	68
22	3746066	3773021	3799944	3826834	3853693	3880521	3907317	67
23	3907317	3934070	3960798	3987491	4014150	4040775	4067366	66
24	4067366	4093923	4120445	4146932	4173385	4199801	4226183	65
25	4226183	4252528	4278838	4305111	4331348	4357548	4383711	64
26	4383711	4409838	4435927	4461978	4487992	4513967	4539905	63
27	4539905	4565804	4591665	4617486	4643269	4669012	4694716	62
28	4694716	4720380	4746004	4771588	4797131	4822634	4848096	61
29	4848096	4873517	4898897	4924236	4949532	4974787	5000000	60
30	5000000	5025170	5050298	5075384	5100426	5125425	5150381	59
31	5150381	5175293	5200161	5224986	5249766	5274502	5299193	58
32	5299193	5323930	5348640	5373299	5397877	5422397	5446830	57
33	5446830	5471073	5495094	5519070	5543603	5567790	5591929	56
34	5591929	5616021	5640066	5664062	5688011	5711912	5735764	55
35	5735764	5759568	5783233	5807070	5830678	5854294	5877853	54
36	5877853	5901361	5924819	5948228	5971586	5994893	6018150	53
37	6018150	6041356	6064511	6087614	6110666	6133666	6156615	52
38	6156615	6179511	6202355	6225146	6247885	6270573	6	

## COSINES



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DEGREES	MINUTES								
	0'	10'	20'	30'	40'	50'	60'		
450	.7071068	.7091607	.7112086	.7132504	.7152963	.7173161	.7193398	440	
46	.7193398	.7213743	.7233690	.7253744	.7273736	.7293668	.7313537	43	
47	.7313537	.7333453	.7353090	.7372773	.7392394	.7411953	.7431448	42	
48	.7431448	.7450881	.7470251	.7489557	.7508800	.7527980	.7547096	41	
49	.7547096	.7566148	.7585136	.7604060	.7622919	.7641714	.7660444	40	
50	.7660444	.7679110	.7697710	.7716246	.7734716	.7753121	.7771460	39	
51	.7771460	.7789733	.7807940	.7826082	.7844157	.7862165	.7880108	38	
52	.7880108	.7897983	.7915792	.7933533	.7951208	.7968815	.7986355	37	
53	.7986355	.8003827	.8021231	.8038569	.8055837	.8073038	.8090170	36	
54	.8090170	.8107234	.8124229	.8141155	.8158013	.8174804	.8191520	35	
55	.8191520	.8208170	.8224751	.8241262	.8257703	.8274074	.8290376	34	
56	.8290376	.8306607	.8322768	.8338858	.8354878	.8370827	.8386706	33	
57	.8386706	.8402513	.8418249	.8433914	.8449508	.8465030	.8480481	32	
58	.8480481	.8495860	.8511167	.8526402	.8541564	.8556653	.8571673	31	
59	.8571673	.8586619	.8601491	.8616292	.8631019	.8645673	.8660254	30	
60	.8660254	.8674762	.8689196	.8703557	.8717844	.8732058	.8746197	29	
61	.8746197	.8760263	.8774254	.8788171	.8802014	.8815782	.8829476	28	
62	.8829476	.8843095	.8856639	.8870108	.8883503	.8896824	.8910065	27	
63	.8910065	.8923234	.8936326	.8949344	.8962285	.8975157	.8987940	26	
64	.8987940	.9000654	.9013292	.9025853	.9038338	.9050746	.9063078	25	
65	.9063078	.9075533	.9087871	.9099961	.9111637	.9123584	.9135455	24	
66	.9135455	.9147247	.9158963	.9170601	.9182161	.9193644	.9205049	23	
67	.9205049	.9216637	.9228162	.9238795	.9249888	.9260902	.9271839	22	
68	.9271839	.9282696	.9293495	.9304176	.9314797	.9325364	.9335804	21	
69	.9335804	.9346189	.9356495	.9366722	.9376869	.9386938	.9396920	20	
70	.9396926	.9406835	.9416665	.9426415	.9436085	.9445678	.9455186	19	
71	.9455186	.9464616	.9473966	.9483237	.9492426	.9501536	.9510566	18	
72	.9510566	.9519514	.9528382	.9537170	.9545876	.9554502	.9563048	17	
73	.9563048	.9571572	.9579935	.9588197	.9596418	.9604589	.9612617	16	
74	.9612617	.9620594	.9628430	.9636305	.9644037	.9651689	.9659258	15	
75	.9659258	.9666744	.9674152	.9681476	.9688719	.9695879	.9702957	14	
76	.9702957	.9709953	.9716867	.9723699	.9730449	.9737116	.9743701	13	
77	.9743701	.9750203	.9756623	.9762960	.9769215	.9775388	.9781476	12	
78	.9781476	.9787843	.9794106	.9799247	.9805205	.9811080	.9816872	11	
79	.9816872	.9822571	.9828203	.9832549	.9837808	.9842985	.9848078	10	
80	.9848078	.9853087	.9858010	.9862856	.9867615	.9872291	.9876883	9	
81	.9876883	.9881392	.9885817	.9890159	.9894416	.9898590	.9902681	8	
82	.9902681	.9906687	.9910610	.9914449	.9918204	.9921874	.9925462	7	
83	.9925462	.9929065	.9932684	.9936317	.9939869	.9943434</			

## COSINES

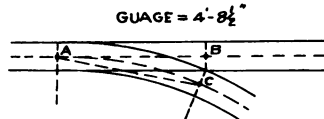
TABLE VII.—NATURAL TANGENTS AND COTANGENTS

TANGENTS							
DEGREES	MINUTES						
	0'	10'	20'	30'	40'	50'	60'
0°	.0000000	.0029089	.0058178	.0087269	.0116361	.0145454	.0174551
1	.0174551	.0203650	.0232753	.0261859	.0290970	.0320086	.0349208
2	.0349208	.0378335	.0407469	.0436609	.0465757	.0494913	.0524078
3	.0524078	.0553251	.0582434	.0611626	.0640829	.0670043	.0699268
4	.0699268	.0728505	.0757753	.0787017	.0816293	.0845583	.0874887
5	.0874887	.0904206	.0933540	.0962890	.0992257	.1021641	.1051042
6	.1051042	.1080462	.1109899	.1139356	.1168832	.1198329	.1227846
7	.1227846	.1257384	.1286943	.1316525	.1346129	.1375757	.1405408
8	.1405408	.1435084	.1464784	.1494510	.1524262	.1554040	.1583844
9	.1583844	.1613677	.1643537	.1673426	.1703344	.1733292	.1763270
10	.1763270	.1793279	.1823319	.1853390	.1883495	.1913632	.1943803
11	.1943803	.1974008	.2004248	.2034523	.2064834	.2095181	.2125566
12	.2125566	.2155988	.2186448	.2216947	.2247485	.2278063	.2308682
13	.2308682	.2339342	.2370044	.2400788	.2431575	.2462405	.2493280
14	.2493280	.2524200	.2555165	.2586176	.2617234	.2648339	.2679492
15	.2679492	.2710694	.2741945	.2773245	.2804597	.2835999	.2867454
16	.2867454	.2898961	.2930521	.2962135	.2993803	.3025527	.3057307
17	.3057307	.3089143	.3121036	.3152988	.3184999	.3217067	.3249197
18	.3249197	.3281387	.3313639	.3345953	.3378330	.3410771	.3443276
19	.3443276	.3475846	.3508483	.3541186	.3573956	.3606795	.3639702
20	.3639702	.3672680	.3705728	.3738847	.3772038	.3805302	.3838640
21	.3838640	.3872053	.3905541	.3939105	.3972746	.4006465	.4040262
22	.4040262	.4074139	.4108097	.4142136	.4176257	.4210460	.4244748
23	.4244748	.4279121	.4313579	.4348124	.4382756	.4417477	.4452287
24	.4452287	.4487187	.4522179	.4557263	.4592439	.4627710	.4663077
25	.4663077	.4698539	.4734098	.4769755	.4805512	.4841368	.4877326
26	.4877326	.4913386	.4949549	.4985816	.5022189	.5058668	.5095254
27	.5095254	.5131950	.5168755	.5205671	.5242698	.5279839	.5317094
28	.5317094	.5354465	.5391952	.5429557	.5467281	.5505125	.5543091
29	.5543091	.5581179	.5619391	.5657728	.5696191	.5734783	.5773503
30	.5773503	.5812353	.5851335	.5890450	.5929699	.5969084	.6008606
31	.6008606	.6048266	.6088067	.6128008	.6168092	.6208320	.6248694
32	.6248694	.6289214	.6329883	.6370703	.6411673	.6452797	.6494076
33	.6494076	.6535511	.6577103	.6618856	.6660769	.6702843	.6745085
34	.6745085	.6787492	.6830066	.6872810	.6915725	.6958813	.7002075
35	.7002075	.7045515	.7089133	.7132931	.7176911	.7221075	.7265425
36	.7265425	.7309963	.7354691	.7399611	.7444724	.7490033	.7535541
37	.7535541	.7581248	.7627157	.7673270	.7719589	.7766118	.7812856
38	.7812856	.7859808	.7906975	.7954359	.8001963	.8049790	.8097840
39	.8097840	.8146118	.8194625	.8243364	.8292337	.8341547	.8390996
40	.8390996	.8440688	.8490624	.8540807	.8591240	.8641926	.8692867
41	.8692867	.8744067	.8795528	.8847253	.8899244	.8951506	.9004040
42	.9004040	.9056851	.9109940	.9163312	.9216969	.9270914	.9325151
43	.9325151	.9379683	.9434513	.9489646	.9545083	.9600829	.9656888
44	.9656888	.9712262	.9768956	.9826973	.9885316	.9943991	1.0000000
DEGREES	MINUTES						
	60'	50'	40'	30'	20'	10'	0'

COTANGENTS

TABLE VIII.—FROGS AND SWITCHES

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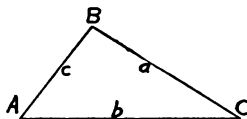
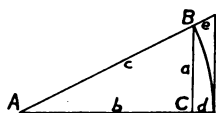
FROG NO.	FROG ANGLE	TURNOUT RADIUS	CURVE DEGREE	Theoretical Lead AB	CHORD AC	FROG NO.
4	14-15'	150.67	38-46'	37.67	37.38	4
4½	12-41	190.69	30-24	42.37	42.12	4½
5	11-25	235.42	24-31	47.08	46.85	5
5½	10-23	284.85	20-13	51.79	51.58	5½
6	9-32	339.00	16-58	56.50	56.31	6
6½	8-48	397.85	14-26	61.21	61.03	6½
7	8-10	461.42	12-27	65.92	65.75	7
7½	7-38	529.69	10-50	70.62	70.47	7½
8	7-09	602.67	9-31	75.33	75.19	8
8½	6-44	680.35	8-26	80.04	79.90	8½
9	6-22	762.75	7-31	84.75	84.62	9
9½	6-02	849.85	6-45	89.46	89.34	9½
10	5-43	941.66	6-05	94.17	94.05	10
11	5-12	1139.4	5-02	103.58	103.47	11
12	4-46	1356.0	4-14	113.00	112.90	12
13	4-24	1591.4	3-36	122.42	122.33	13
14	4-05	1845.6	3-06	131.83	131.75	14

TABLE IX.—A.S.C.E. STANDARD RAIL SECTIONS.

WEIGHT LBS. PER YARD	WIDTH OF HEAD INCHES	WIDTH OF BASE INCHES	WEIGHT LBS. PER YARD	WIDTH OF HEAD INCHES	WIDTH OF BASE INCHES	WEIGHT LBS. PER YARD	WIDTH OF HEAD INCHES	WIDTH OF BASE INCHES
40	1½	3½	65	2½½	4½	90	2½	5½
45	2	3½	70	2½	4½	95	2½	5½
50	2½	3½	75	2½½	4½	100	2½	5½
55	2½	4½	80	2½	5	Height of rail same as width of base		
60	2½	4½	85	2½	5½			

TABLE X.—INCHES IN DECIMALS OF A FOOT.

INCHES	0	1	2	3	4	5	6	7	8	9	10	11	INCHES
0	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	0	1/16
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219	1/8
1/8	.0104	.0937	.1771	.2604	.3437	.4271	.5104	.5937	.6771	.7604	.8437	.9271	3/16
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323	1/4
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375	5/16
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427	3/8
3/8	.0312	.1146	.1979	.2812	.3646	.4479	.5312	.6146	.6979	.7812	.8646	.9479	7/16
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531	1/2
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583	9/16
9/16	.0469	.1302	.2135	.2969	.3802	.4635	.5469	.6302	.7135	.7969	.8802	.9635	5/8
5/8	.0521	.1354	.2187	.3021	.3854	.4687	.5521	.6354	.7187	.8021	.8854	.9687	11/16
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740	3/4
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792	7/8
7/8	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844	15/16
15/16	.0729	.1562	.2396	.3229	.4062	.4896	.5729	.6562	.7396	.8229	.9062	.9896	1
1	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948	



## SOLUTION OF RIGHT TRIANGLES.

1.  $\sin A = \frac{a}{c} = \cos B$
2.  $\cos A = \frac{b}{c} = \sin B$
3.  $\tan A = \frac{a}{b} = \cot B$
4.  $\cot A = \frac{b}{a} = \tan B$
5.  $\sec A = \frac{c}{b} = \operatorname{cosec} B$
6.  $\operatorname{cosec} A = \frac{c}{a} = \sec B$
7.  $\operatorname{vers} A = \frac{d}{c} = \frac{c-b}{c}$
8.  $\operatorname{exsec} A = \frac{e}{c}$

## SOLUTION OF OBLIQUE TRIANGLES.

9.  $\frac{\sin A}{\sin B} = \frac{a}{b}$
10.  $\frac{\sin A}{\sin C} = \frac{a}{c}$
11.  $\frac{\sin B}{\sin C} = \frac{b}{c}$
12.  $A+B+C = 180^\circ$
13.  $\frac{1}{2}(A+B) = 90^\circ - \frac{1}{2}C$
14.  $\tan \frac{1}{2}(A-B) = \frac{a-b}{a+b} \tan \frac{1}{2}(A+B)$
15.  $A = \frac{1}{2}(A+B) + \frac{1}{2}(A-B)$
16.  $B = \frac{1}{2}(A+B) - \frac{1}{2}(A-B)$
17.  $\text{area} = \frac{1}{2}bc \sin A$
- Let  $s = \frac{1}{2}(a+b+c)$
18.  $\sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}$
19.  $\text{area} = \sqrt{s(s-a)(s-b)(s-c)}$

## GENERAL FORMULAS.

20.  $\sin^2 A + \cos^2 A = 1$
21.  $\frac{\sin A}{\cos A} = \tan A$
22.  $\operatorname{vers} A = 1 - \cos A$
23.  $\operatorname{exsec} A = \sec A - 1 = \frac{\operatorname{vers} A}{\cos A}$

1. Extra Width of Gauge on Curves.

The gauge should be widened  $\frac{1}{24}"$  for each degree of curve.

2. Elevation of outer Rail on Curves.

For a speed of 55 miles per hour the elevation =  $2" \times (\text{degree of curve})$ .  
The elevation varies as the square of the speed. Thus for a  $4^\circ$  curve and a speed of 40 miles per hour elevation =  $2 \times 4 \times \left(\frac{40}{55}\right)^2 = 4\frac{1}{4}"$ .

3. Middle Ordinates for curving Rails.

For a 30' rail the ordinate =  $.02' \times (\text{degree of curve})$ . The ordinate varies as the square of the length of rail. Thus for an  $8^\circ$  curve and a 26' rail ordinate =  $.02 \times 8 \times \left(\frac{26}{30}\right)^2 = .12'$

4. Rule for Keeping Joints square on a Curve.

Cut a rail of any length at a point distant from center of rail  $\left(\frac{1}{2} \times \frac{L}{100} \times D\right)$  inches. In this formula L = length of curve in feet and D = degree of curve. Use the longer piece on the outer rail and the shorter piece on the inner rail.

5. Expansion of a Steel Rail.

Steel expands .01' per 100' for each  $15^\circ F$ . rise in temperature. Thus if the temperature changes from  $0^\circ$  to  $90^\circ$  a 30' rail will expand  $\left(.01 \times \frac{30}{100} \times \frac{90}{15}\right) = .018'$

6. To determine the Degree of Curve of a Track without a Transit.

First Method. On standard gauge track the degree of curve =  $\left(\frac{466}{C}\right)^2$ , in which C = long chord of outer gauge line tangent to inner gauge line, the middle ordinate being the gauge of the track.

Second Method. If the long chord of outer gauge line = 62' the middle ordinate in inches = degree of curve.

### 7. Compensation for Curvature.

To make resistance on a curve equal to resistance on a tangent decrease the grade on the curve  $.05\% \times (\text{degree of curve})$ .

### 8. Tons of Rail per Mile of Track.

The number of tons of 2240 lbs. in a mile of track  $= \frac{11}{7} \times (\text{weight per yard})$ . Thus for a 56 lbs. rail tons per mile  $= \frac{11}{7} \times 56 = 88$ .

### 9. Formula giving the Radius of a Reversed Curve between Parallel Tangents.

Let  $p$  = perpendicular distance between tangents,  
and  $d$  = length of chord from P.C. to P.T.

Then Radius  $= \frac{d^2}{4p}$ . (exact formula)

### 10. Approximate Values of E, C and M for a curve of Radius R and Degree D. (see table II)

If  $\Delta$  is less than  $20^\circ$ ,

$$\text{I. } E = \frac{1}{4} \times \frac{7}{8} \times \frac{\Delta^2}{D} \quad (\text{approx.})$$

$$\text{II. } M = \frac{1}{4} \times \frac{7}{8} \times \frac{\Delta^2}{D} \quad (\text{approx.})$$

$$\text{III. } M = \frac{C^2}{8R} \quad (\text{approx.})$$

$$\text{IV. } C = \sqrt{8RM} \quad (\text{approx.})$$

As  $\Delta$  increases beyond  $20^\circ$  the error in using these formulas increases more rapidly, formulas I and III giving values too small and formulas II and IV giving values too large.

### 11. Correction for Curvature in chaining Track.

The correction for a 100' station  $= .04 \times (\text{degree of curve})$ . Each station should be shortened by this amount when chaining on inner rail and lengthened by the same amount when chaining on outer rail.

## 12. Correction for Grade in chaining Track.

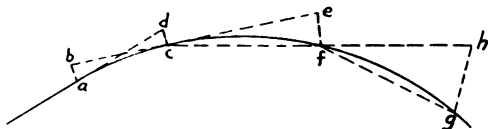
In chaining on a grade each 100' station should be lengthened by an amount equal to the square of the grade divided by 200. Thus on a 3% grade the correction per station is  $\frac{3^2}{200} = .045'$  and the correction per mile  $52.8 \times .045 = 2.376'$ .

In its general form this formula becomes  $K = \frac{h^2}{2b}$ , in which  $b$  = the base of a right triangle and  $h$  the altitude,  $h$  being small in comparison with  $b$ .  $K$  = the amount the hypotenuse is longer than the base. Thus in laying off a right-angled distance of 66' suppose an obstacle is encountered but a point may be set 2.3' off of the right-angled line. The distance on the hypotenuse will be  $66 + \frac{(2.3)^2}{2 \times 66} = 66.04'$

## 13. Method of locating a Curve by Offsets without a Transit.

Approximate offset from tangent =  $\frac{7}{8} \left( \frac{L}{100} \right)^2 D$ , in which  $L$  = length of curve and  $D$  = degree of curve.

Given a 2°30' curve. Station of P.C. = 176+32. Required to set points at each station on the curve.



Point  $a$  = P.C. of curve.

Extend the tangent from  $a$  to  $d$  making  $ad = 68'$ .

$$cd = \frac{7}{8} \left( \frac{68}{100} \right)^2 \times 2.5 = 1.01'$$

Measuring 68' from  $a$  and 1.01' from  $d$  locates station 177 at  $c$ .

Locate point  $b$  by measuring 68' from  $c$  and 1.01' from  $a$ .  $bc$  is tangent to the curve at  $c$ .

$$\text{Extend } bc \text{ to } e \text{ making } ce = 100'. \quad ef = \frac{7}{8} \left( \frac{100}{100} \right)^2 \times 2.5 = 2.09'$$

Measuring 100' from  $c$  and 2.09' from  $e$  locates station 178 at  $f$ .

$$\text{Extend chord } cf \text{ to } h \text{ making } fh = 100'. \quad 2 \times 2.09 = 4.18' = hg.$$

Measuring 100' from  $f$  and 4.18' from  $h$  locates station 179 at  $g$ .

Locate the remaining stations same as station 179. If the 1st station is near the P.C. set the 2nd station from original tangent.

Let  $A$  = any angle expressed in degrees and decimals of a degree.  
 $\tan$  = natural tangent of  $A$ .

$R$  = radius of a curve whose degree =  $D$ .

$A$  may be expressed in terms of  $\tan$  by the following formulas:

- (1)  $A = 57.3 \left( \tan - \frac{\tan^3}{3} \right)$  for values of  $\tan$  from 0 to .25
- (2)  $A = \left[ 60 - \frac{100}{6} (\tan - .1) \right] \tan - .6 + \tan$  for values of  $\tan$  from .25 to .50
- (3)  $A = \left[ 60 - \frac{100}{6} (\tan - .1) \right] \tan - \frac{10}{6} (.75 - \tan)^2$  for values of  $\tan$  from .50 to .75
- (4)  $A = \left[ 60 - \frac{100}{6} (\tan - .1) \right] \tan - .01$  for values of  $\tan$  from .75 to 1.00

For approximate results the above formulas may be simplified as follows:

- (5)  $A = 57.3 \tan$  for values of  $\tan$  from 0 to .25
- (6)  $A = \left[ 60 - \frac{100}{6} (\tan - .1) \right] \tan$  for values of  $\tan$  from .25 to 1.00

$R$  may be expressed in terms of  $D$  as follows:

$$(7) R = \frac{5729.58}{D} + .073 D$$

ERROR IN USING FORMULAS 5 AND 6.

Tangent	Angle by Form. 5	Angle by Form. 6	Exact Angle	Error in Minutes	Tangent	Angle by Form. 6	Exact Angle	Error in Minutes
0.05	2°-51.9'		2°-51.8'	+0.1	0.5	26°-40'	26°-33.9'	+6.1
0.1	5-43.1		5-42.6	+1.2	0.6	31-0	30-57.8	+2.2
0.2	11-27.6		11-18.6	+9.0	0.7	35-0	34-59.5	+0.5
0.25	14-19.5	14°-22.5'	14-02.2	+20.3	0.8	38-40	38-39.6	+0.4
0.3		17-0	16-42.0	+18.0	0.9	42-0	41-59.2	+0.8
0.4		22-0	21-48.1	+11.9	1.0	45-0	45-0	0.0

ERROR IN USING FORMULA 7.

D	Radius by Form. 7	Exact Radius	Error	D	Radius by Form. 7	Exact Radius	Error
0°-15'	22918.34	22918.33	+0.1	11°	521.67	521.67	0
0-30	11459.20	11459.19	+0.1	12	478.34	478.34	0
0-45	7639.49	7639.49	0	13	441.69	441.68	+0.1
1-0	5729.65	5729.65	0	14	410.28	410.28	0
1-30	3819.83	3819.83	0	15	383.07	383.06	+0.1
2	2864.94	2864.93	+0.1	16	359.27	359.26	+0.1
3	1910.08	1910.08	0	17	338.28	338.27	+0.1
4	1432.69	1432.69	0	18	319.62	319.62	0
5	1146.28	1146.28	0	19	302.94	302.94	0
6	955.37	955.37	0	20	287.94	287.94	0
7	819.02	819.02	0	25	231.01	231.01	0
8	716.78	716.78	0	30	193.18	193.19	-0.1
9	637.29	637.27	+0.1	35	166.26	166.28	-0.2
10	573.69	573.69	0	40	146.16	146.19	-0.3



## ERROR IN USING FORMULAS 1, 2, 3 AND 4.

Tangent	Angle by Formula 1	Exact Angle	Error in Minutes	Tangent	Angle by Formula 2	Exact Angle	Error in Minutes
.005	0°-17.2'	0°-17.2'	0.0	.25	14°-01.5'	14°-02.2'	-0.7
.01	0-34.4	0-34.4	0.0	.26	14-34.0	14-34.5	-0.5
.02	1-08.8	1-08.8	0.0	.27	15-06.3	15-06.6	-0.3
.03	1-43.1	1-43.1	0.0	.28	15-38.4	15-38.5	-0.1
.04	2-17.4	2-17.4	0.0	.29	16-10.3	16-10.3	0.0
.05	2-51.8	2-51.8	0.0	.30	16-42.0	16-42.0	0.0
.06	3-26.0	3-26.0	0.0	.31	17-13.5	17-13.4	+0.1
.07	4-00.3	4-00.2	+0.1	.32	17-44.8	17-44.7	+0.1
.08	4-34.5	4-34.4	+0.1	.33	18-15.9	18-15.8	+0.1
.09	5-08.6	5-08.6	0.0	.34	18-46.8	18-46.7	+0.1
.10	5-42.7	5-42.6	+0.1	.35	19-17.5	19-17.4	+0.1
.11	6-16.7	6-16.6	+0.1	.36	19-48.0	19-47.9	+0.1
.12	6-50.6	6-50.6	0.0	.37	20-18.3	20-18.3	0.0
.13	7-24.4	7-24.4	0.0	.38	20-48.4	20-48.4	0.0
.14	7-58.2	7-58.2	0.0	.39	21-18.3	21-18.3	0.0
.15	8-31.8	8-31.8	0.0	.40	21-48.0	21-48.1	-0.1
.16	9-05.4	9-05.4	0.0	.41	22-17.6	22-17.6	-0.1
.17	9-38.8	9-38.9	-0.1	.42	22-46.8	22-46.9	-0.1
.18	10-12.2	10-12.2	0.0	.43	23-15.9	23-16.1	-0.2
.19	10-45.4	10-45.5	-0.1	.44	23-44.8	23-45.0	-0.2
.20	11-18.4	11-18.6	-0.2	.45	24-13.5	24-13.7	-0.2
.21	11-51.4	11-51.6	-0.2	.46	24-42.0	24-42.1	-0.1
.22	12-24.2	12-24.3	-0.1	.47	25-10.3	25-10.4	-0.1
.23	12-56.8	12-57.2	-0.4	.48	25-38.4	25-38.5	-0.1
.24	13-29.3	13-29.7	-0.4	.49	26-06.3	26-06.3	0.0
.25	14-01.6	14-02.2	-0.6	.50	26-34.0	26-33.9	+0.1

Tangent	Angle by Formula 3	Exact Angle	Error in Minutes	Tangent	Angle by Formula 4	Exact Angle	Error in Minutes
.50	26°-33.8'	26°-33.9'	-0.1	.75	36°-51.9'	36°-52.2'	-0.3
.51	27-01.1	27-01.3	-0.2	.76	37-13.8	37-14.1	-0.3
.52	27-28.3	27-28.5	-0.2	.77	37-35.5	37-35.8	-0.3
.53	27-55.3	27-55.4	-0.1	.78	37-57.0	37-57.3	-0.3
.54	28-22.0	28-22.1	-0.1	.79	38-18.3	38-18.5	-0.2
.55	28-48.5	28-48.6	-0.1	.80	38-39.4	38-39.6	-0.2
.56	29-14.8	29-14.9	-0.1	.81	39-00.3	39-00.4	-0.1
.57	29-40.9	29-41.0	-0.1	.82	39-21.0	39-21.1	-0.1
.58	30-06.7	30-06.8	-0.1	.83	39-41.5	39-41.6	-0.1
.59	30-32.3	30-32.4	-0.1	.84	40-01.8	40-01.8	0.0
.60	30-57.8	30-57.8	0.0	.85	40-21.9	40-21.9	0.0
.61	31-22.9	31-23.0	-0.1	.86	40-41.8	40-41.7	+0.1
.62	31-47.9	31-47.9	0.0	.87	41-01.5	41-01.4	+0.1
.63	32-12.7	32-12.7	0.0	.88	41-21.0	41-20.9	+0.1
.64	32-37.2	32-37.2	0.0	.89	41-40.3	41-40.1	+0.2
.65	33-01.5	33-01.4	+0.1	.90	41-59.4	41-59.2	+0.2
.66	33-25.6	33-25.5	+0.1	.91	42-18.3	42-18.1	+0.2
.67	33-49.5	33-49.3	+0.2	.92	42-37.0	42-36.8	+0.2
.68	34-13.1	34-13.0	+0.1	.93	42-55.5	42-55.4	+0.1
.69	34-36.5	34-36.3	+0.2	.94	43-13.8	43-13.7	+0.1
.70	34-59.7	34-59.5	+0.2	.95	43-31.9	43-31.9	0.0
.71	35-22.7	35-22.5	+0.2	.96	43-49.8	43-49.9	-0.1
.72	35-45.5	35-45.2	+0.3	.97	44-07.5	44-07.6	-0.1
.73	36-08.1	36-07.8	+0.3	.98	44-25.0	44-25.3	-0.3
.74	36-30.4	36-30.1	+0.3	.99	44-42.3	44-42.3	-0.4
.75	36-52.5	36-52.2	+0.3	1.00	44-59.4	45-00.0	-0.6

## Use of Formulas.

Given a 4° curve.  $\Delta = 37^{\circ}44'$ . To find  $T$ .

$\frac{1}{2}\Delta = 18^{\circ}52'$ . By trial  $\tan \frac{1}{2}\Delta$  is found to be between .3 and .4  
 since if  $\tan = .4$  in formula (6)  $A = 22^{\circ}0'$   
 and if  $\tan = .3$  in formula (6)  $A = 17^{\circ}0'$

Change of .1 in  $\tan$  changes  $A$  by  $5^{\circ}0'$

$$\frac{18^{\circ}52' - 17^{\circ}0'}{17^{\circ}52' - 17^{\circ}0'} \cdot \frac{152}{5}(.1) = .04 \quad .3 + .04 = .34 = \text{approximate } \tan \frac{1}{2}\Delta.$$

$\tan \frac{1}{2}\Delta$  lies between .25 and .50 Therefore use formula (2)

If  $\tan = .34$  in formula (2)  $A = 18.78^{\circ} = 18^{\circ}46.8'$

If  $\tan = .35$  in formula (2)  $A = 19.292^{\circ} = 19^{\circ}17.5'$

Change of .01 in  $\tan$  changes  $A$  by  $0^{\circ}30.7'$

$$\frac{18^{\circ}52' - 18^{\circ}46.8'}{0^{\circ}05.2'} \cdot \frac{5.2}{30.7}(.01) = .00169 \quad .34 + .00169 = .34169 = \tan \frac{1}{2}\Delta.$$

$$\text{By formula (7)} \quad R = \frac{5729.58}{4} + .073(4) = 1432.69$$

$$T = R \tan \frac{1}{2}\Delta = 1432.69 \times .34169 = 489.54$$

Exact  $\tan 18^{\circ}52' = .34173$ , Error .00004

Exact  $T = 489.59$ , Error .05'

$\sin \frac{1}{2}\Delta$  and  $\cos \frac{1}{2}\Delta$  may be derived from  $\tan \frac{1}{2}\Delta$  by combining the two formulas,

$$\sin^2 \frac{1}{2}\Delta + \cos^2 \frac{1}{2}\Delta = \tan^2 \frac{1}{2}\Delta$$

$$\text{and} \quad \frac{\sin \frac{1}{2}\Delta}{\cos \frac{1}{2}\Delta} = \tan \frac{1}{2}\Delta.$$

$$\text{Also } \text{vers} \frac{1}{2}\Delta = 1 - \cos \frac{1}{2}\Delta. \quad \text{Exsec} \frac{1}{2}\Delta = \sec \frac{1}{2}\Delta - 1 = \frac{1}{\cos \frac{1}{2}\Delta} - 1.$$

$$E = R \text{exsec} \frac{1}{2}\Delta. \quad C = 2R \sin \frac{1}{2}\Delta. \quad M = R \text{vers} \frac{1}{2}\Delta. \quad X = R \sin \Delta. \quad Y = R \text{vers} \Delta.$$

Thus any function of a curve may be found by first finding  $\tan \Delta$  or  $\tan \frac{1}{2}\Delta$ .

To find an angle whose tangent is greater than 1.00 find the angle corresponding to  $\frac{1}{\tan}$  and subtract from  $90^\circ$ .

Given  $\tan = 1.246$  To find A.

$$\frac{1}{1.246} = .8025682$$

This number lies between .75 and 1.00 Therefore use formula (4).

Substituting  $\tan = .8025682$  in formula (4) gives  $38^\circ 44.8'$

$$90^\circ - (38^\circ 44.8') = 51^\circ 15.2' = A.$$

$$\text{Exact } A = 51^\circ 15.0', \text{ Error } 0^\circ 0.2'$$


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To find the tangent of an angle greater than  $45^\circ$  take the reciprocal of the tangent of  $(90^\circ - \text{the angle})$ .

Required the tangent of  $56^\circ 43'$ .

$$90^\circ - (56^\circ 43') = 33^\circ 17'$$

$$\text{If } \tan = .7 \text{ in formula (6) } A = 35^\circ 0'$$

$$\text{If } \tan = .6 \text{ in formula (6) } A = 31^\circ 0'$$

Change of .1 in  $\tan$  changes A by  $4^\circ 0'$

$$\frac{33^\circ 17' - 31^\circ 0'}{2^\circ 17'} = \frac{2^\circ 17'}{4} (.1) = .06 \quad .6 + .06 = .66 = \text{approximate } \tan 33^\circ 17'$$

$\tan 33^\circ 17'$  lies between .50 and .75 Therefore use formula (3)

$$\text{If } \tan = .66 \text{ in formula (3) } A = 33^\circ 25.6'$$

$$\text{If } \tan = .65 \text{ in formula (3) } A = 33^\circ 01.5'$$

Change of .01 in  $\tan$  changes A by  $0^\circ 24.1'$

$$\frac{33^\circ 17' - 33^\circ 01.5'}{0^\circ 15.5'} = \frac{15.5}{24.1} (.01) = .00643 \quad .65 + .00643 = .65643 = \tan 33^\circ 17'$$

$$\frac{1}{.65643} = 1.52339 = \tan 56^\circ 43'$$

$$\text{Exact } \tan 56^\circ 43' = 1.52332, \text{ Error } .00007$$